SOIL SURVEY OF

Daviess and Hancock Counties, Kentucky

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Kentucky Agricultural Experiment Station

Issued November 1974

Major fieldwork for this soil survey was done in the period 1965–69. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Daviess County and Hancock County Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Daviess and Hancock Counties are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the section that discusses use of the soils for crops and pasture.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others concerned with wildlife can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Use of Soils for Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Daviess and Hancock Counties may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about these counties given at the beginning of the publication and in the section "General Nature of the Area."

Cover: **Area of Loring silty clay loam, 12 to 25 percent slopes, severely eroded, used for permanent pasture. The soil on which the house in the background is located is Memphis silt loam, 2 to 6 percent slopes.**

U.S. GOVERNMENT PRINTING OFFICE: 1974

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

CONTENTS

Issued November 1974

SOIL SURVEY OF DAVIESS AND HANCOCK COUNTIES, KENTUCKY

BY FRANK R. COX, JR., SOIL CONSERVATION SERVICE

SOIL SURVEYED BY HENRY T. CONVERSE, JR., FRANK R. COX, JR., JOHN L. TAYLOR, AND ORVILLE J. WHITAKER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

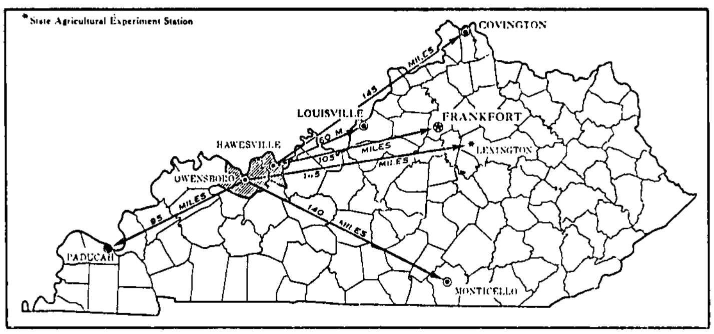


Figure 1.—**Location of Daviess and Hancock Counties in Kentucky.**

DAVIESS AND HANCOCK COUNTIES are in the northwestern part of Kentucky (fig. 1). They are bounded on the north by the Ohio River, on the west by Henderson County, on the south by McLean and Ohio Counties, and on the east by Breckinridge County.

Daviess County has an area of about 462 square miles, and Hancock County has an area of about 187 square miles. Owensboro is the county seat of Daviess County, and Hawesville is the county seat of Hancock County. The only other incorporated towns are Whitesville, in Daviess County, and Lewisport, in Hancock County.

These counties are in the eastern part of the Western Coal Field. The highest elevation, in the southeastern part of Hancock County, is about 840 feet. The lowest, in the northwestern part of Daviess County, is about 370 feet. Drainage is to the north and west.

Relief ranges from level to hilly. Most of the hilly areas are in the southern and eastern parts of the survey area. The northern and western parts contain wide valleys, where nearly level soils occupy the valley floors. They also contain uplands, where the soils are undulating to rolling. A large area in the central and northwestern parts of Daviess County consists mostly of nearly level soils.

Most of the soils on uplands are well drained or moderately well drained. Susceptibility to erosion limits their use for some purposes. Soils on the stream terraces and on flood plains are poorly drained to well drained. Wetness is the main limitation to use of those soils.

Farming has always been important in these two counties. The nearly level soils are used to grow corn and soybeans, and they are also used extensively for small grain, tobacco, hay, and pasture. In recent years many areas of hilly soils have been abandoned as farmland and have reverted to forest. Industries located in the northern part of Hancock County and in the vicinity of Owensboro in Daviess County make a large contribution to the economy of the area.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Daviess and Hancock Counties, where they are located, and how they can be used. The soil scientists went into the two counties knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shapes of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by weathering, leaching, or the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Memphis and Uniontown, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristics that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Memphis silt loam, 2 to 6 percent slopes, is one of several phases within the Memphis series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit, the soil complex, is shown on the soil map of Daviess and Hancock Counties.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Frondorf-Wellston silt loams, 12 to 20 percent slopes, is an example.

In most areas surveyed, there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Daviess and Hancock Counties. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Areas shown on the general soil map at the back of this survey are adjacent to areas shown on the general soil map in the soil survey of Henderson County (*29*).[1] Soil associations in Daviess and Hancock Counties differ from those in Henderson County in several ways. Association 1, the Elk-Otwell-Ginat association of Daviess and Hancock Counties, for example, is adjacent to the Ginat-Melvin association of Henderson County. It is similar to that association, except that it contains a larger proportion of well drained and moderately well drained soils. Association 2, the Uniontown-Patton-Henshaw association of Daviess County, is separated only by the Green River from the Markland-Sharkey-Newark association of Henderson County. It differs from that association in that the major soils are less clayey. The Green River also separates association 2 of Daviess County from the Loring-Wellston-Zanesville association, on uplands in Henderson County. Association 2 differs from the Loring-Wellston-Zanesville association in that the soils are less sloping and they have formed in alluvium instead of in loess or in loess over sandstone.

---

[1] Italic numbers in parentheses refer to Literature Cited, p. 105.

The soil associations of Daviess and Hancock Counties are described in the paragraphs that follow. The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association 1, the words "medium textured" refer to the texture of the surface layer.

1. Elk-Otwell-Ginat Association

Nearly level to sloping, deep, well drained to poorly drained, medium-textured soils on stream terraces and flood plains

This association is along the northern boundary of Daviess and Hancock Counties. It consists of two disconnected areas. The larger one extends from the Henderson County line on the west to near Hawesville on the east. The smaller one is in the northeastern part of Hancock County. It is an area of low ridges separated by flats (fig. 2). The ridges are roughly parallel to each other and to the Ohio River. They are as much as 800 feet wide and extend upward 4 to 5 feet above the flats.

This association occupies about 20 percent of the survey area. About 17 percent of it is Elk soils, about 10 percent is Otwell soils, and about 9 percent is Ginat soils. The remaining 64 percent is minor soils.

The Elk and Otwell soils are on ridges, and the Ginat soils are on flats. Elk soils are deep, are well drained, and are mostly nearly level to sloping. They are brown and have a moderately fine textured subsoil. Otwell soils have a deep fragipan, are moderately well drained, and are mostly nearly level or gently sloping. Ginat soils have a fragipan, are poorly drained, and are nearly level. They are gray and have a medium-textured or moderately fine textured subsoil.

Minor soils in this association are the Wheeling, Ashton, and Weinbach, on stream terraces, and the Bruno, Huntington, Lindside, Newark, Jacob, and Melvin, on flood plains.

Most of the soils in this association are suited to intensive cultivation. The soils on flood plains are subject to flooding by the Ohio River and are used mainly for corn and soybeans. The soils on stream terraces rarely are flooded. They are used for row crops, hay, and pasture. The well-drained soils on ridges are suitable for growing tobacco and are good sites for farmsteads.

Most of the farms in this association are less than 200 acres in size. Most of them are operated by the owner. In some areas that are frequently flooded, however, the operator who owns the farm does not live on it.

2. Uniontown-Patton-Henshaw Association

Nearly level to sloping, deep, well drained to poorly drained, medium-textured soils formed in neutral alluvium on stream terraces and flood plains

This association is in the southwestern and west-central parts of Daviess County. The soils are mainly nearly level and are in areas crossed by streams. In places the streams flow through sloughs that have sloping sides (fig. 3).

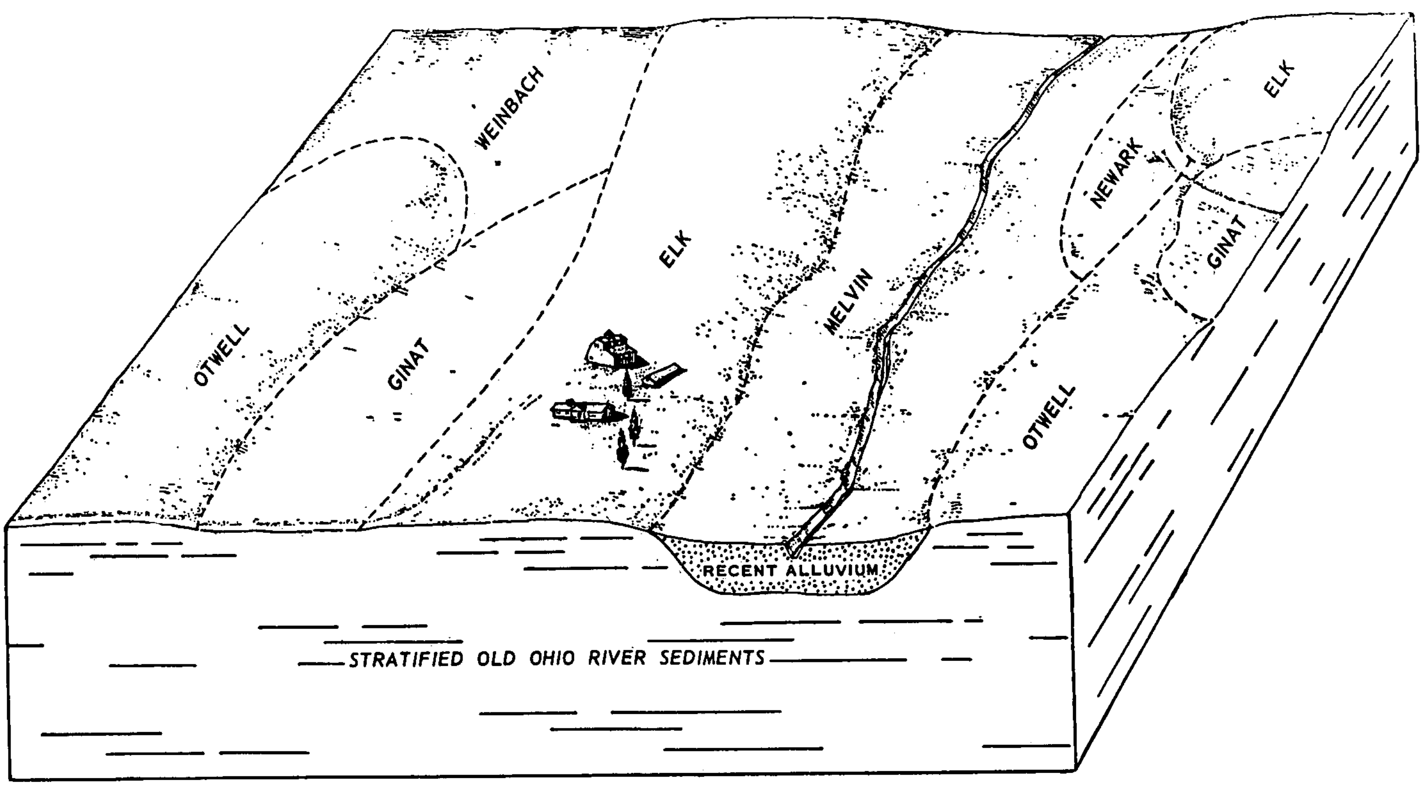


***Figure 2.*—Relationship of the soils to relief and underlying material in the Elk-Otwell-Ginat association.**

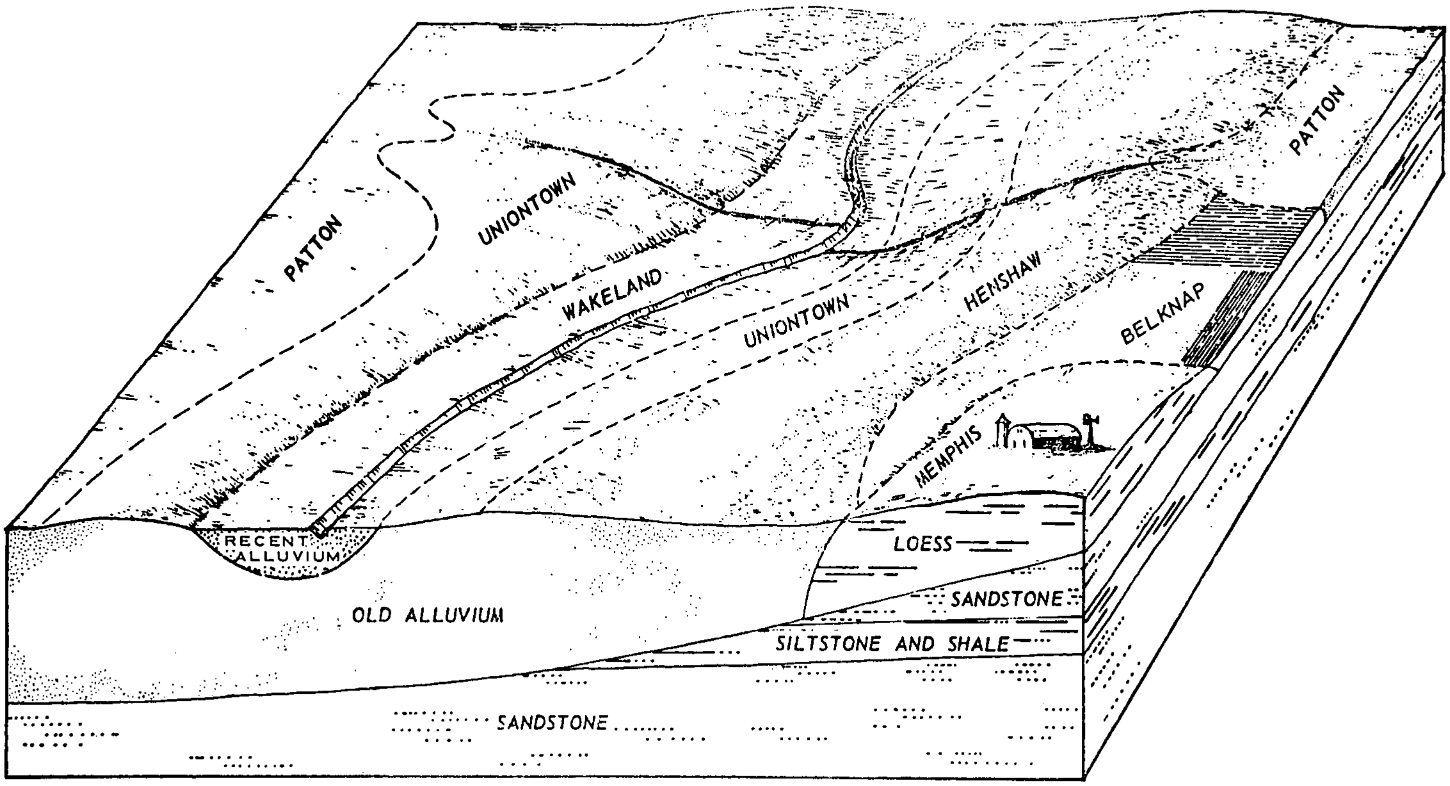


Figure 3.—**Relationship of the soils to relief and underlying material in the Uniontown-Patton-Henshaw association.**

This association occupies about 9 percent of the survey area. About 13 percent of it is Uniontown soils, about 12 percent is Patton soils, and about 11 percent is Henshaw soils. The rest is minor soils.

Uniontown soils are mostly in areas slightly higher than those occupied by surrounding soils, and they are on side slopes adjacent to the flood plains in some places. They are nearly level to sloping, are deep, and are well drained or moderately well drained. The subsoil is medium textured to moderately fine textured. Patton soils are mostly in wide areas and in slight depressions. They are nearly level, deep, and poorly drained. Their subsoil is medium textured. Henshaw soils, in slightly higher areas than adjacent soils, are nearly level, deep, and somewhat poorly drained. Their subsoil is moderately fine textured.

Minor soils in this association are the Memphis, Loring, Grenada, and Calloway, on uplands; the Markland and McGary, on stream terraces; and the Wakeland, Belknap, Waverly, and Wilbur, on flood plains.

Most areas of this association are farmed intensively. The nearly level soils are used mostly for corn and soybeans. The sloping areas and some areas of nearly level soils are used mainly for hay and pasture. Drainage is needed to make the poorly drained soils more suitable for cultivated crops. Some areas are subject to flooding, mostly by runoff from higher areas. A few low areas also receive backwater from the Ohio and the Green Rivers.

Most farms average about 175 acres and are operated by the owner. On many farms corn and soybeans are the only crops grown. The crops on other farms are mainly corn, soybeans, small grain, hay, and pasture.

3. Belknap-Karnak-Waverly Association

Nearly level, deep, somewhat poorly drained and poorly drained, medium-textured to fine-textured soils on flood plains.

This association is in the central part of Daviess County. It consists of nearly level, deep soils on flood plains.

This association occupies about 13 percent of the survey area. About 34 percent of it is Belknap soils, 23 percent is Karnak soils, and 20 percent is Waverly soils. The rest consists of minor soils.

Belknap soils are mostly in the eastern part of the association. They are somewhat poorly drained and are medium textured throughout. Karnak soils are dominant in the western part of the association. They are poorly drained and are fine textured throughout. Waverly soils are mostly in the northern and eastern parts of the association. They are poorly drained and are medium textured throughout.

Minor soils in this association are the Wakeland, Melvin, and Collins, on flood plains, and the Memphis and Grenada, on uplands.

Soils of this association are used mainly for row crops, chiefly corn and soybeans. A few areas are in tobacco, hay, pasture, or trees. The soils in a few large wooded tracts have not been drained. Improving drainage would

make most of these soils more suitable for crops, and some of them are not suitable for cultivated crops unless they are drained. Most of the soils are subject to flooding. Ditches tend to become clogged with silt and debris, and they generally need dredging every few years. Erosion is not a hazard in most areas.

The average size of farms is about 175 acres. Most of the farms are operated by the owner. Many of the farm operators who reside on their farm live in the higher areas, where the soils are better drained and are not subject to flooding.

4. Loring-Memphis-Belknap Association

Gently sloping to steep, deep, well drained and moderately well drained, medium-textured soils on uplands and nearly level, deep, somewhat poorly drained, medium-textured soils on flood plains.

This association is in the northern and western parts of the survey area. Within its boundaries are Bon Harbor Hills; the uplands near St. Joseph, West Louisville, Habit, Dermont, Panther, Thruston, and Yelvington in Daviess County; and the uplands south and east of Lewisport in Hancock County. The landscape is characterized by an area of uplands and flood plains. The soils on uplands formed in loess. In the uplands are gently sloping soils on narrow winding hilltops and sloping to steep soils on sides of hills. Nearly level soils are in long valleys on the flood plains (fig. 4).

This association occupies about 25 percent of the survey area. About 35 percent of it is Loring soils, about 29 percent is Memphis soils, and 18 percent is Belknap soils. The rest consists of minor soils.

The Loring and Memphis soils are on uplands, and the Belknap soils are on flood plains. Both the Loring and Memphis soils are on side slopes, and the Memphis soils are also on hilltops. The Loring soils have a fragipan and are moderately well drained. The Memphis soils are deep and well drained. The Belknap soils are nearly level and are medium textured throughout. Their subsoil contains grayish mottles, a characteristic of somewhat poorly drained soils.

Minor soils in this association are in the Grenada, Calloway, Collins, Wellston, Waverly, Wilbur, Wakeland, and Melvin series.

Soils throughout most of this association are used for general farming. Many of the soils on uplands are sloping to steep, and their susceptibility to erosion limits their use for cultivated crops. They are mainly used for hay or pasture or have been left in trees. The nearly level soils on flood plains and the gently sloping soils on uplands are suited to intensive cultivation. They are used for corn, tobacco, soybeans, hay, and pasture.

On most farms in this association, some of the soils are on uplands and some are on flood plains. As a result, the cropping system generally includes both cultivated crops and permanent vegetation. The farms are mostly about 120 acres in size, but some are larger than 400 acres. Most of the farms are operated by the owner. On many of the small farms, the operator works part time on the farm and is employed elsewhere part time. Some industrial workers live in rural areas along the major roads. Others reside in a few housing developments near Owensboro.

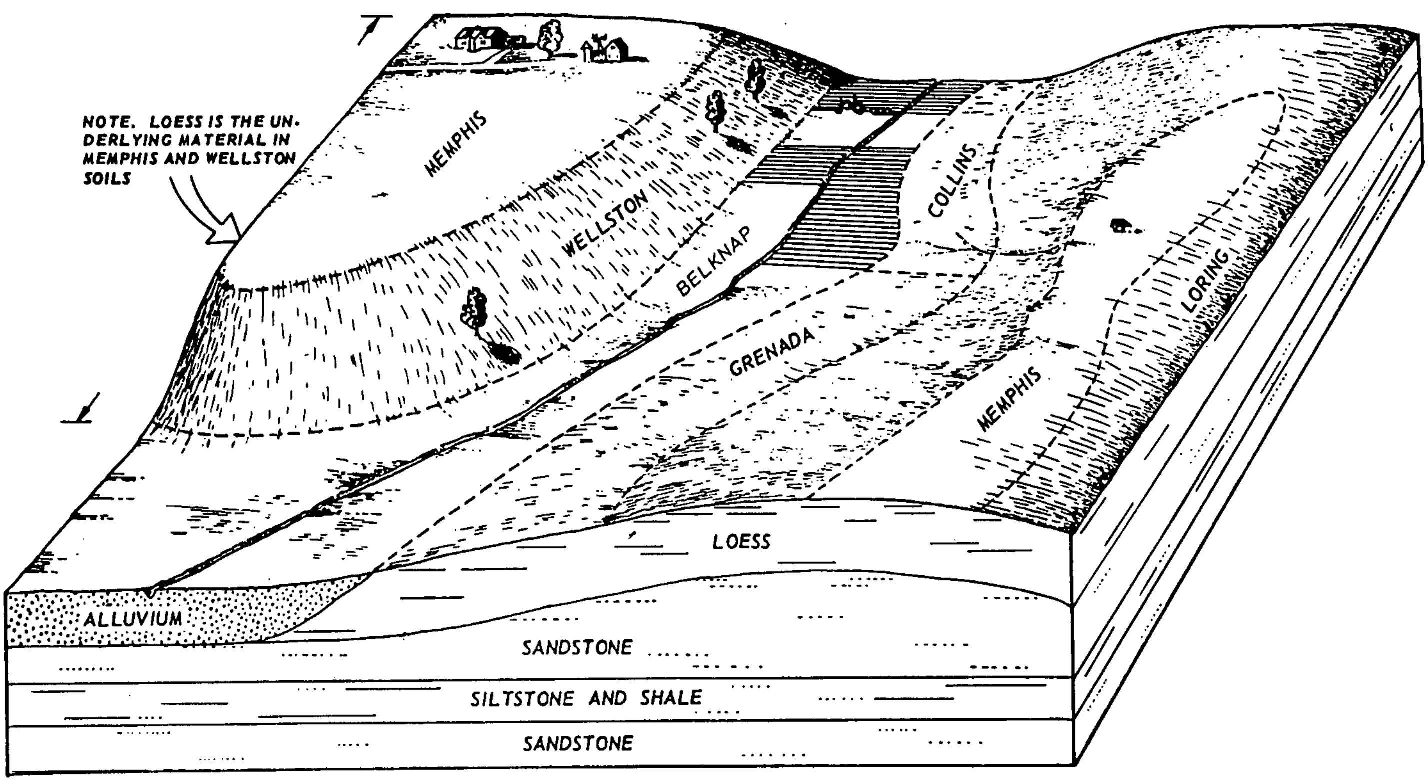


Figure 4.—**Relationship of the soils to relief and underlying material in the Loring-Memphis-Belknap association.**

5. Loring-Wellston Association

Gently sloping to moderately steep, deep, moderately well drained and well drained, medium-textured soils on uplands

This soil association is in the eastern and southern parts of Daviess County, mainly in rolling and hilly areas near Knottsville, Whitesville, and Pleasant Ridge. Gently sloping and sloping soils are on narrow, winding hilltops. Sloping to moderately steep soils are on sides of hills. Part of the soils formed in loess and part formed in loess and residuum. Valleys that dissect the area are long and narrow.

This association occupies about 15 percent of the survey area. About 37 percent of it is Loring soils, and about 23 percent is Wellston soils. The rest is minor soils.

Loring soils are on hilltops and on some sides of hills, and the Wellston soils are on sides of hills. The Loring soils are brown, have a fragipan, and are moderately well drained. They have formed in loess, and they have a medium textured or moderately fine textured subsoil. The Wellston soils, also brown, are deep to bedrock and are well drained. They have formed in loess and in material weathered from sandstone, siltstone, and shale. The subsoil of the Wellston soils is medium textured or moderately fine textured, like that of the Loring soils.

Minor soils in this association are the Memphis, Frondorf, and Grenada, on uplands, and the Collins and Belknap, on flood plains.

The dominant soils in this association are subject to erosion. The sloping areas can be cultivated occasionally if practices are used to protect them from erosion. The moderately steep areas generally are suited only to permanent vegetation. Most of the soils on hilltops are suited to corn, tobacco, hay, and pasture. Soils on the sides of hills are suited to hay, pasture, and trees. Those on the narrow flood plains scattered throughout the association are suited to corn, soybeans, hay, and pasture.

The average size of farms in this association is about 100 acres. General farming is practiced in most places. Most of the farms are operated by the owner, who lives on the farm. Soils throughout most of this association were formerly cultivated. Large areas have since been abandoned as farmland and are reverting to broomsedge, briers, and trees. Some areas of steeper soils that have never been cultivated are in trees.

6. Wellston-Frondorf-Zanesville Association

Gently sloping to steep, well drained and moderately well drained, deep and moderately deep, medium-textured soils on uplands

This soil association is in the central and southern parts of Hancock County. It is a hilly area of gently sloping to steep soils on uplands. The soils formed in a thin layer of loess and in material weathered from sandstone, siltstone, and shale. The area is dissected by narrow valleys (fig. 5).

This association makes up about 18 percent of the survey area. About 49 percent of it is Wellston soils, about 20 percent is Frondorf soils, and about 11 percent is Zanesville soils. The rest consists of minor soils.

Wellston soils are mostly sloping to moderately steep and are on the sides of hills. They are deep over bedrock; are well drained; and have a brown, medium textured or moderately fine textured subsoil. Frondorf soils are strongly sloping to steep and are also on the sides of hills. They are moderately deep over bedrock; are well drained; and have a brown, moderately fine textured subsoil that contains fragments of sandstone. Zanesville soils are gently sloping and sloping and are on the tops of hills. They have a fragipan; are well drained or moderately well drained; and have a brown, medium-textured subsoil.

Minor soils in this association are the Loring, on uplands, and the Clifty, Collins, Belknap, and Waverly, on flood plains. On some hillsides a minor acreage is also occupied by rock outcrops.

Throughout much of this association, the hazard of erosion is severe and the soils are suited only to permanent vegetation. The steep soils are mostly in trees. Soils on the narrow hilltops are suitable for cultivation if they are protected from erosion, and those on the narrow flood plains adjacent to streams can also be cultivated. Some of the soils on sides of hills are suited to permanent hay or pasture. They are mostly better suited to trees.

A few farms that have an average size of about 100 acres are scattered throughout the association. On these farms tobacco, sorghum, corn, hay, and pasture crops are grown. Soils throughout a large part of this association were formerly cultivated. Some of these soils have been abandoned for farming and are revegetating through natural processes.

Descriptions of the Soils

This section describes the soil series and mapping units in Daviess and Hancock Counties. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gullied land, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

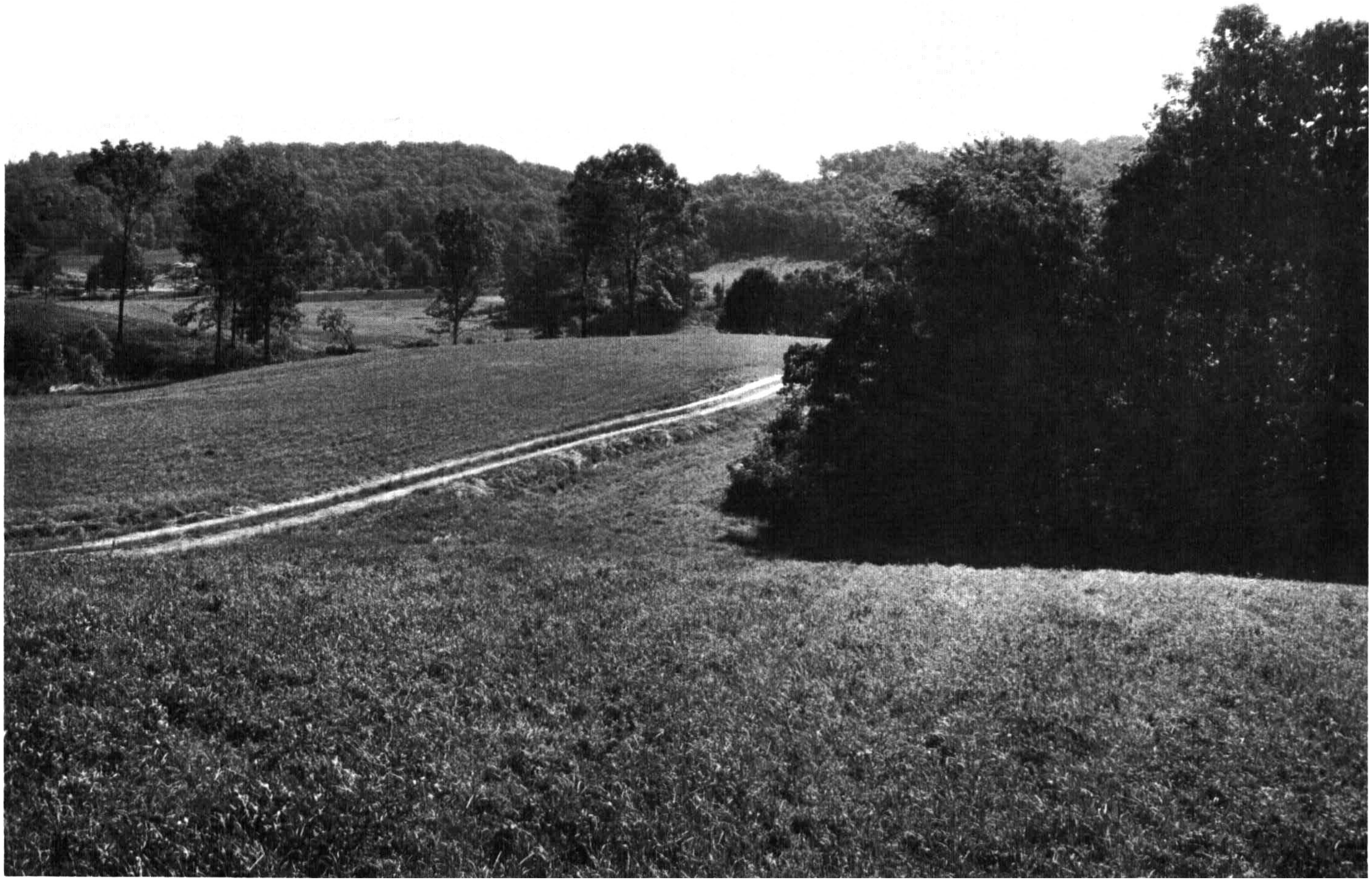


Figure 5.—**Typical landscape in the Wellston-Frondorf-Zanesville association. Wellston and Frondorf soils are on the sides of hills, and Zanesville soils are on the hilltops. Collins and Belknap soils are on flood plains in the valleys.**

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland group in which the mapping unit has been placed. The page for the description of each capability unit, woodland group, or other interpretative group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary. More detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*25*).

Alluvial Land, Steep

Alluvial land, steep (AlF), consists mainly of mixed, undifferentiated sediment on steep banks along the Ohio and the Green Rivers. Most areas are flooded annually, and a few low areas are flooded several times in most years. The characteristics of this land type are variable, for the material consists of stratified sand, silt, and clay. During each flood, many areas either gain new sediment or lose part of the surface soil. Slopes generally range from about 20 to 50 percent, but this land type ranges from level, in low areas that are flooded frequently, to steep and clifflike where the bank is undermined by the current.

Most areas of this land type are in trees. The trees help to reduce cutting of the streambanks, and they slow the current during floods. As a result, sand is deposited on the streambanks instead of on productive bottom lands. Capability unit VIIe-3; woodland suitability group 3s1.

Ashton Series

The Ashton series consists of soils that are deep, well drained, and nearly level. These soils are on flood plains of the Ohio River, in the northern part of the survey area. They have formed in alluvium derived from limestone, sandstone, siltstone, shale, glacial till, and loess.

In a representative profile, the surface layer is dark-brown silt loam about 7 inches thick. The upper part of the subsoil is dark-brown and brown silty clay loam that

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Mapping unit	Daviess County		Hancock County		Total	
	Acres	Percent	Acres	Percent	Acres	Percent
Alluvial land, steep	1,670	0.6	390	0.3	2,060	0.5
Ashton silt loam	2,160	.7	530	.4	2,690	.7
Belknap silt loam	40,780	13.8	9,230	7.7	50,010	12.2
Bruno loamy fine sand	250	.1	70	.1	320	.1
Calloway silt loam	3,620	1.2	310	.3	3,930	.9
Clifty gravelly loam			1,520	1.3	1,520	.4
Collins silt loam	6,410	2.2	3,590	2.9	10,000	2.4
Elk silt loam, 0 to 2 percent slopes	7,410	2.5	1,430	1.2	8,840	2.1
Elk silt loam, 2 to 6 percent slopes	1,980	.7	970	.8	2,950	.7
Elk silt loam, 6 to 12 percent slopes	260	.1	170	.1	430	.1
Elk silt loam, 12 to 50 percent slopes	350	.1	210	.2	560	.1
Elk silty clay loam, 6 to 12 percent slopes, severely eroded	570	.2	190	.2	760	.2
Frondorf-Wellston silt loams, 12 to 20 percent slopes	560	.2	2,110	1.8	2,670	.6
Frondorf-Wellston silt loams, 12 to 20 percent slopes, severely eroded	2,400	.8	5,680	4.7	8,080	1.9
Frondorf-Wellston silt loams, 20 to 30 percent slopes	830	.3	9,790	8.2	10,620	2.6
Frondorf-Wellston silt loams, 20 to 30 percent slopes, severely eroded	940	.3	4,950	4.1	5,890	1.4
Frondorf-Wellston silt loams, 30 to 50 percent slopes	240	.1	9,590	8.0	9,830	2.4
Ginat silt loam	5,400	1.8	1,940	1.6	7,340	1.8
Grenada silt loam, 0 to 2 percent slopes	3,590	1.2	250	.2	3,840	.9
Grenada silt loam, 2 to 6 percent slopes	9,460	3.2	1,440	1.2	10,900	2.6
Gullied land	350	.1	170	.1	520	.1
Henshaw silt loam	3,610	1.2	540	.5	4,150	1.0
Huntington silt loam	3,450	1.2	1,990	1.7	5,440	1.3
Jacob silty clay loam	2,830	1.0	230	.2	3,060	.7
Karnak silt loam, overwash	2,710	.9	450	.4	3,160	.7
Karnak silty clay	10,610	3.6	60	.1	10,670	2.6
Lakin loamy fine sand, 0 to 2 percent slopes	320	.1			320	.1
Lindside silt loam	930	.3	1,400	1.2	2,330	.6
Loring silt loam, 0 to 2 percent slopes	500	.2	50	(1)	550	.1
Loring silt loam, 2 to 6 percent slopes	16,540	5.6	1,320	1.1	17,860	4.3
Loring silt loam, 6 to 12 percent slopes	10,990	3.7	2,660	2.2	13,650	3.3
Loring silt loam, 12 to 25 percent slopes	980	.3	80	.1	1,060	.3
Loring silty clay loam, 6 to 12 percent slopes, severely eroded	19,650	6.7	420	.4	20,070	4.8
Loring silty clay loam, 12 to 25 percent slopes, severely eroded	11,220	3.8	740	.6	11,960	2.9
McGary silt loam	2,300	.8	310	.3	2,610	.6
Markland silt loam, 0 to 2 percent slopes	170	.1			170	(1)
Markland silt loam, 12 to 30 percent slopes	370	.1	10	(1)	380	.1
Markland silty clay loam, 2 to 6 percent slopes, eroded	270	.1			270	.1
Markland silty clay, 6 to 12 percent slopes, severely eroded	390	.1	10	(1)	400	.1
Markland silty clay, 12 to 30 percent slopes, severely eroded	170	.1	250	.2	420	.1
Melvin silt loam	7,200	2.4	1,160	.9	8,360	2.0
Memphis silt loam, 0 to 2 percent slopes	1,680	.6	180	.2	1,860	.4
Memphis silt loam, 2 to 6 percent slopes	11,020	3.7	270	.2	11,290	2.7
Memphis silt loam, 6 to 12 percent slopes	5,620	2.0	640	.5	6,260	1.5
Memphis silt loam, 12 to 30 percent slopes	2,120	.7	1,950	1.6	4,070	1.0
Memphis silt loam, 30 to 60 percent slopes	1,450	.5	50	(1)	1,500	.4
Memphis silty clay loam, 6 to 12 percent slopes, severely eroded	6,900	2.3	310	.3	7,210	1.7
Memphis silty clay loam, 12 to 30 percent slopes, severely eroded	9,150	3.1	1,780	1.5	10,930	2.6
Montgomery silty clay loam	660	.2	210	.2	870	.2
Newark silt loam	3,720	1.3	2,360	1.9	6,080	1.5
Otwell silt loam, 0 to 2 percent slopes	4,070	1.4	1,880	1.6	5,950	1.4
Otwell silt loam, 2 to 6 percent slopes	1,100	.4	1,160	1.0	2,260	.5
Patton silt loam	2,980	1.0	240	.2	3,220	.8
Patton silt loam, overwash	1,790	.6	70	.1	1,860	.4
Sciotoville loam, 0 to 2 percent slopes	280	.1	40	(1)	320	.1
Shelocta silt loam, 6 to 12 percent slopes			510	.4	510	.1
Shelocta silt loam, 12 to 25 percent slopes			300	.3	300	.1
Strip mine spoil	3,670	1.2	940	.8	4,610	1.1
Uniontown silt loam, 0 to 2 percent slopes	3,030	1.0	260	.2	3,290	.8
Uniontown silt loam, 2 to 6 percent slopes	1,270	.4	160	.1	1,430	.3
Uniontown silty clay loam, 6 to 12 percent slopes, severely eroded	960	.3	120	.1	1,080	.3
Urban land	1,170	.4			1,170	.3
Wakeland silt loam	7,880	2.7	50	(1)	7,930	1.9
Waverly silt loam	14,160	4.8	3,100	2.6	17,260	4.2
Weinbach silt loam	3,480	1.2	2,520	2.1	6,000	1.4
Wellston silt loam, 6 to 12 percent slopes	20	(1)	2,410	2.0	2,430	.6
Wellston silt loam, 6 to 12 percent slopes, severely eroded	40	(1)	2,330	1.9	2,370	.6

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Mapping unit	Daviess County		Hancock County		Total	
	Acres	Percent	Acres	Percent	Acres	Percent
Wellston silt loam, 12 to 20 percent slopes	1, 870	. 6	3, 310	2. 8	5, 180	1. 2
Wellston silt loam, 20 to 30 percent slopes	1, 930	. 7	2, 640	2. 2	4, 570	1. 1
Wellston silt loam, 12 to 30 percent slopes, severely eroded	12, 120	4. 1	13, 960	11. 7	26, 080	6. 3
Wheeling loam, 0 to 2 percent slopes	1, 590	. 5	220	. 2	1, 810	. 4
Wheeling loam, 2 to 6 percent slopes	1, 240	. 4	230	. 2	1, 470	. 4
Wheeling loam, 6 to 12 percent slopes	430	. 1	20	(1)	450	. 1
Wilbur silt loam	3, 140	1. 1	180	. 2	3, 320	. 8
Zanesville silt loam, 2 to 6 percent slopes	70	(1)	2, 610	2. 2	2, 680	. 6
Zanesville silt loam, 6 to 12 percent slopes	80	(1)	5, 140	4. 3	5, 220	1. 3
Zanesville silt loam, 6 to 12 percent slopes, severely eroded	420	. 1	1, 210	1. 0	1, 630	. 4
Gravel pits, water areas, etc.	130	(1)	110	. 1	240	. 1
Total	295, 680	100. 0	119, 680	100. 0	415, 360	100. 0

Less than 0.05 percent.

is firm to a depth of about 18 inches and is very firm between depths of 18 and 34 inches. The next layer is dark-brown, mottled, very firm silty clay loam that extends to a depth of about 54 inches. The lower part of the subsoil is brown, very firm heavy silty clay loam that extends to a depth of 60 inches or more.

Natural fertility is high, and the content of organic matter is medium. Permeability is moderate; roots and moisture can penetrate to a suitable depth for crops to grow well. Available moisture capacity is high.

Crops grown on these soils respond well to applications of fertilizer, but lime generally is not needed.

Representative profile of Ashton silt loam (in Daviess County, 3 miles east of Stanley and 800 feet south of the Ohio River, beside a large pipeline):

Ap—0 to 7 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; friable; mildly alkaline; clear, smooth boundary.

B21—7 to 18 inches, dark-brown (10YR 4/3) silty clay loam; moderate, coarse, angular blocky structure; dark-brown (10YR 3/3) coatings; firm; slightly acid; gradual, smooth boundary.

B22t—18 to 34 inches, brown (10YR 4/3) silty clay loam; moderate, medium, prismatic structure that parts to moderate, coarse, angular blocky structure; very firm, slightly plastic, compact; clay films; dark-brown (10YR 3/3) coatings; medium acid; diffuse, smooth boundary.

B23t—34 to 54 inches, dark-brown (10YR 4/3) silty clay loam; common, medium, faint mottles of brown (10YR 5/3) and grayish brown (10YR 5/2); moderate, medium, prismatic structure that parts to moderate, coarse, subangular blocky structure; very firm, slightly plastic, compact; clay films; medium acid; diffuse, smooth boundary.

B24t—54 to 60 inches, brown (7.5YR 4/4) heavy silty clay loam; moderate, medium, prismatic and moderate, coarse, subangular blocky structure; very firm, slightly plastic, compact; clay films; medium acid.

The matrix of the B21 and B22t horizons in dark brown (7.5YR 4/4) to brown (10YR 4/3). Reaction in those horizons ranges from medium acid to neutral. Dominant color of the B23t and B24t horizons is dark brown (10YR 4/3) or brown (7.5YR 4/4). Mottles in those horizons are few or common and range from dark gray (10YR 4/1) to yellowish brown (10YR 5/6) in color. Texture of the B23t and B24t horizons is light silty clay loam or heavy silty clay loam. Consistence of those horizons is firm or very firm, and reaction is medium acid to slightly acid The solum ranges from 40 to 75 inches in thickness. Depth to bedrock is more than 50 feet.

Ashton soils mapped in this survey area have a thicker solum and a slightly higher content of clay in the B horizon than indicated in the defined range for the series. These differences do not alter the usefulness and behavior of the soils.

Ashton soils are near Bruno, Huntington, and Lindside soils. They lack the sandy texture that is typical throughout the profile of Bruno soils, and they have a finer textured subsoil and a better developed profile than Huntington and Lindside soils. Ashton soils lack the grayish colors in the subsoil that are typical in the subsoil of Lindside soils. They are similar to Elk soils in drainage, but they have a darker surface layer than those soils.

Ashton silt loam (0 to 4 percent slopes) (As).—This is the only Ashton soil mapped in the survey area. It is on flood plains of the Ohio River, where it occurs on low benches and stream terraces. The areas are between areas of lower lying soils on flood plains and areas of higher lying soils on stream terraces. They generally contain low ridges that are separated by narrow flats. Size of the areas ranges from 50 to 500 acres.

Included with this soil in mapping were a few areas of Huntington and Lindside soils; areas of a soil that has a surface layer of silty clay loam; and areas of a soil in which the lower part of the subsoil is strongly acid. Also included were areas of moderately well drained soils, and areas of a soil that has a brown surface layer.

This Ashton soil is not subject to erosion, and it can be used safely year after year for cultivated crops. Flooding is a hazard, but it occurs mainly in winter and in spring. The floodwaters generally do not damage crops that grow in summer.

This soil is used mostly for corn and soybeans. Capability unit I-3; woodland suitability group 1o1.

Belknap Series

The Belknap series consists of deep, nearly level soils that are acid and are somewhat poorly drained. These soils are mostly on flood plains in the southern and eastern parts of the survey area. They have formed in alluvium washed from loess.

In a representative profile, the surface layer is brown silt loam about 6 inches thick. The subsoil is brown, mottled, friable silt loam to a depth of about 18 inches. Below that depth and extending to a depth of about 30 inches, it is grayish-brown, mottled, friable silt loam. The substratum, also mottled, is grayish-brown, very friable silt loam in the upper part and is dark-gray, very friable silt loam in the lower part. The substratum extends to a depth of 50 inches or more.

Available moisture capacity is high, and permeability is moderate. Natural fertility is moderate, and the content of organic matter is low. Penetration of roots and moisture is good if artificial drainage is provided to lower the seasonal high water table.

These soils are easy to till and can be tilled throughout a wide range of moisture content. Crops grown on them respond well to applications of lime and fertilizer.

Representative profile of Belknap silt loam (in Daviess County, three-fourths mile south of the junction of Hills Bridge Road and U.S. Highway No. 231, one-fourth mile east of a 90-degree turn in Hills Bridge Road, 200 feet south of a barn, and 50 feet west of a ditch):

Ap—0 to 6 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B21—6 to 18 inches, brown (10YR 5/3) silt loam; few, fine, faint, grayish-brown (10YR 5/2) and dark grayish-brown (10YR 4/2) mottles; weak, fine, granular structure; friable; few worm casts; strongly acid; gradual, smooth boundary.

B22g—18 to 30 inches, grayish-brown (10YR 5/2) silt loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, fine, granular structure; friable; strongly acid; gradual, smooth boundary.

C1g—30 to 40 inches, grayish-brown (2.5Y 5/2) silt loam; few, coarse, distinct mottles of light yellowish brown (10YR 6/4) and a few, fine, faint mottles of olive brown (2.5Y 4/4); massive; very friable; strongly acid; clear, smooth boundary.

C2g—40 to 50 inches, dark-gray (N 4/0) silt loam; few, fine, distinct mottles of olive brown (2.5Y 4/4); massive; very friable; strongly acid.

Color of the Ap horizon ranges from brown (10YR 5/3) to dark yellowish brown (10YR 4/4). Dominant color of the B21 horizon is brown (10YR 5/3) to dark yellowish brown (10YR 4/4). Mottles in the B21 horizon are common to many and are gray (10YR 5/1) to dark grayish brown (10YR 4/2). The B22g horizon is light brownish gray (10YR 6/2) to dark grayish brown (10YR 4/2) and is light silt loam or silt. Mottles in that horizon are common or many and are pale brown (10YR 6/3) to dark yellowish brown (10YR 4/4). The C horizon is dominantly silt loam, but the texture of that horizon ranges from silt to light silty clay loam. The C horizon is dark gray (N 4/0) to light gray (10YR 7/2) or light brownish gray (2.5Y 6/2), and it contains grayish and brownish mottles. Reaction throughout the profile is strongly acid or very strongly acid. Thickness of the solum ranges from 25 to 45 inches. Bedrock is at a depth of more than 7 feet.

Belknap soils are near Clifty, Collins, and Waverly soils. They contain less gravel and are more grayish than Clifty soils. Their subsoil is more grayish than that of Collins soils, and it is less grayish than that of Waverly soils. Belknap soils are similar to Newark and Wakeland soils in drainage, but they are more acid than those soils. Their subsoil contains less clay than that of the Newark soils.

Belknap silt loam (0 to 2 percent slopes) (Be).—This is the only Belknap soil mapped in the survey area. It is on flood plains, mostly in areas 5 to 100 acres in size. Many of the areas are in narrow valleys near the headwaters of streams.

Included with this soil in mapping were a few areas of Collins, Waverly, and Wakeland soils, and a few areas of soils that have more clay, gravel, or sand throughout the profile than this Belknap soil. Also included were areas of a soil that contains reddish mottles, and areas of a soil that has light-gray mottles in the upper part of the subsoil.

This Belknap soil is not subject to erosion and can be cultivated intensively. Flooding is a hazard, mostly in winter and in spring. Applying the proper kinds and amounts of fertilizer, adding lime, and improving drainage increase suitability of this soil for crops.

This soil is used mainly for corn, soybeans, hay, pasture, and trees. A few areas are idle. Capability unit IIw-1; woodland suitability group 1w1.

Bruno Series

In the Bruno series are sandy, excessively drained soils that are deep and nearly level. These soils are mostly in the northern part of the survey area near the Ohio River. They have formed in sandy alluvium that was deposited by that river.

In a representative profile, the surface layer is brown loamy fine sand about 5 inches thick. The underlying material, to a depth of 50 inches or more, is brown, loose loamy fine sand that contains thin layers of dark-brown fine sandy loam.

Available moisture capacity and natural fertility are low, and permeability is rapid. These soils are not subject to clodding and crusting, and they are easily penetrated by roots.

Crops grown on these soils respond to applications of fertilizer. A small amount of fertilizer applied at frequent intervals is more beneficial than a large amount applied less frequently. In some areas lime is not needed.

Representative profile of Bruno loamy fine sand (in Hancock County, one-fourth mile east of the mouth of Blackford Creek and 200 feet south of the Ohio River):

Ap—0 to 5 inches, brown (10YR 5/3) loamy fine sand; single grain; loose; slightly acid; clear, smooth boundary.

C1—5 to 15 inches, brown (10YR 4/3) loamy fine sand; single grain; loose; medium acid; gradual, smooth boundary.

C2—15 to 18 inches, dark-brown (10YR 3/3) fine sandy loam; single grain; very friable; medium acid; gradual, smooth boundary.

C3—18 to 50 inches, brown (10YR 5/3) loamy fine sand; single grain; loose; contains thin layers of dark-brown (10YR 3/3) material; medium acid.

Colors throughout the profile range from dark brown (10YR 3/3) to yellowish brown (10YR 5/4). Texture throughout the profile is dominantly loamy fine sand and sand, but it is fine sandy loam, sandy loam, loam, or silt loam in some horizons. In other horizons the soil material is stratified. Horizons in which the texture is loam or silt loam have weak or moderate, granular structure. Reaction throughout the profile ranges from strongly acid to neutral. Thickness of the sandy alluvium ranges from about 3 to 5 feet. Depth to bedrock is greater than 50 feet.

The average annual temperature of Bruno soils in Daviess and Hancock Counties is 1 to 2 degrees cooler than the defined range for the series. This difference does not alter the usefulness and behavior of these soils.

Bruno soils are near Huntington, Ashton, and Lindside soils, but they contain more sand than any of those soils. Their texture is similar to that of Lakin soils, but they lack the B horizon that is characteristic of Lakin soils.

Bruno loamy fine sand (0 to 4 percent slopes) (Bu).—This is the only Bruno soil mapped in the survey area. It is on flood plains of the Ohio River. The areas are mostly 5 to 10 acres in size.

Included with this soil in mapping were a few areas of a soil that is less sandy throughout than typical for Bruno soils.

Water that falls as rain filters into and through this Bruno soil. As a result, erosion, in the usual sense, is not a hazard. In some places, however, floodwaters remove soil material or leave new deposits. Flooding generally occurs in winter and in spring, when crops are not growing. Therefore, this soil can be used for most annual crops that are grown in summer. It is better suited to deep-rooted than to shallow-rooted crops. Because of the loose consistence of the surface layer, traction is poor for power vehicles.

This soil is used mainly for row crops, but small areas are in hay, pasture, or trees. In a few places, trees have been planted to help stabilize the soil material. Capability unit IIIs-1; woodland suitability group 3s1.

Calloway Series

The Calloway series consists of deep, somewhat poorly drained, nearly level soils that have a fragipan. These soils occur in widely scattered areas on uplands in the central and southern parts of the survey area. They have formed in loess.

In a representative profile, the surface layer is brown silt loam about 10 inches thick. The upper part of the subsoil is yellowish-brown, mottled, very friable heavy silt loam that extends to a depth of about 20 inches. The next layer is brown, mottled, firm silt loam that extends to a depth of about 27 inches. It is underlain by a firm, brittle and compact fragipan of yellowish-brown, mottled heavy silt loam that extends to a depth of 50 inches or more.

A variable moisture capacity is moderate, natural fertility is moderately low, and the content of organic matter is low. Permeability is moderate above the fragipan and is slow in the fragipan. The root zone is moderately deep. Roots and moisture readily penetrate to the fragipan, but their further penetration is restricted by the pan.

These soils can be worked throughout a wide range of moisture content without clodding or crusting. Crops grown on them respond well to applications of fertilizer and lime.

Representative profile of Calloway silt loam (in Daviess County, 2 miles east of Curdsville, 200 feet north of the Curdsville-Delaware Road, and 20 feet east of a utility pole):

Ap—0 to 10 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

B2t—10 to 20 inches, yellowish-brown (10YR 5/6) heavy silt loam; many, medium, distinct, pale-brown (10YR 6/3) mottles and few, fine, distinct, light-gray (10YR 7/2) mottles; weak, fine, subangular blocky structure; very friable; few roots; few, soft, brown concretions; strongly acid; clear, smooth boundary.

A'2—20 to 27 inches, brown (10YR 5/3) silt loam; common, fine, distinct, light-gray (10YR 7/2) and yellowish-brown, (10YR 5/6) mottles; moderate, coarse, prismatic structure; firm; many pores, mostly in the upper part of horizon; many brown concretions; few roots between peds; strongly acid; gradual, wavy boundary.

B'x—27 to 50 inches, yellowish-brown (10YR 5/8) heavy silt loam; many, coarse, distinct, light-gray (10YR 7/1) mottles; weak, coarse, prismatic structure; firm, brittle, and compact; ped interiors filled with yellowish-brown silt loam; cracks and voids between peds are filled with light-gray clay; strongly acid.

The Ap horizon ranges from brown (10YR 4/3) to grayish brown (10YR 5/2) in color. In places an A2 horizon of brown (10YR 5/3) silt loam, about 3 to 6 inches thick, is immediately beneath the A horizon. Dominant colors in the B2 horizon range from yellowish brown (10YR 5/6) to pale brown (10YR 6/3). Mottles in that horizon are few to many and are pale brown (10YR 6/3) to gray (10YR 5/1) or light gray (10YR 7/2). In some areas the B2 horizon is light silty clay loam. Structure of that horizon is weak or moderate subangular blocky or granular. The A'2 horizon has dominant colors that range from brown (10YR 5/3) to light brownish gray (10YR 6/2). Mottles in that horizon are few or common and are light gray (10YR 7/2) to yellowish brown (10YR 5/6). The B'x horizon contains mottles that are grayish to brownish or yellowish. Its structure ranges from weak, coarse, prismatic to moderate, medium, subangular; and consistence is firm or very firm. Reaction throughout the profile ranges from strongly acid to slightly acid. In all areas thickness of the loess is more than 4 feet. Thickness of the solum ranges from about 36 inches to 60 inches.

The average annual temperature of these soils is 1 to 2 degrees cooler than the defined range for the series. The B&A horizon that is defined for the series is also lacking. These differences do not alter the usefulness and behavior of the soils.

Calloway soils are near Loring, Zanesville, and Grenada soils of uplands and near Belknap soils of flood plains. They have a more grayish subsoil than Loring, Zanesville, and Grenada soils. Their drainage is similar to that of the Belknap and Weinbach soils, but unlike the Belknap soils, they have a fragipan. Calloway soils contain more silt than Weinbach soils, and they are on uplands instead of on stream terraces like the Weinbach soils.

Calloway silt loam (0 to 4 percent slopes) (Ca).—This is the only Calloway soil mapped in the survey area. It occurs mostly at the bases of steeper slopes or in areas slightly higher than the adjacent flood plains. The areas are widely scattered and occur both in Daviess and in Hancock Counties. They are mostly 5 to 20 acres in size.

Included with this soil in mapping were a few areas of Belknap and Grenada soils, and a few areas of a soil that has a grayer subsoil than typical for Calloway soils. Also included were small areas of a soil that has a very strongly acid subsoil.

Erosion generally is not a hazard. Therefore, this Calloway soil can be cultivated intensively. It is not suited to crops that require good drainage, however, because in rainy periods it becomes slightly waterlogged above the slowly permeable fragipan. Drainage of some areas can be improved by installing open ditches and diversions.

Most areas of this soil are used for corn, soybeans, hay, and pasture. Capability unit IIIw-3; woodland suitability group 1w1.

Clifty Series

The Clifty series consists of deep, well-drained, nearly level soils that contain some fragments of sandstone. These soils are on flood plains, mostly in narrow valleys in the central and southern parts of Hancock County. They have formed in alluvium derived from sandstone, siltstone, shale, and loess.

In a representative profile, the surface layer is brown gravelly loam about 8 inches thick. The subsoil is dark yellowish-brown, very friable gravelly silt loam. It is underlain at a depth of about 38 inches by brown, very friable gravelly silt loam that extends to a depth of 50 inches or more.

Available moisture capacity is moderate, permeability is moderately rapid, and the content of organic matter is low. The root zone is deep. Natural fertility is moderately low.

The gravel in the surface layer makes these soils somewhat difficult to work. Response to applications of fertilizer and lime is good.

Representative profile of Clifty gravelly loam (in Hancock County, 2 miles east of Easton, 200 feet northeast of a road junction, and east of ditch in a narrow bottom):

Ap—0 to 8 inches, brown (10YR 4/3) gravelly loam; weak, fine, granular structure; very friable; about 25 percent of horizon is fragments of sandstone, 1 to 8 centimeters in diameter; medium acid; clear, smooth boundary.

B—8 to 38 inches, dark yellowish-brown (10YR 4/4) gravelly silt loam; weak, fine, granular structure; very friable; about 20 percent of horizon is fragments of sandstone, 1 to 5 centimeters in diameter; fine fraction is about 12 percent clay and 10 percent sand; strongly acid; gradual, smooth boundary.

C—38 to 50 inches, brown (10YR 4/3) gravelly silt loam; massive; very friable; about 30 percent of horizon is fragments of sandstone, 1 to 5 centimeters in diameter; strongly acid.

Color of the A horizon ranges from dark brown (10YR 4/3) to brown (10YR 5/3). Reaction of the A horizon is medium acid to neutral in areas that have received lime. Color of the B and C horizons ranges from dark brown (10YR 4/3) to yellowish brown (10YR 5/4). The B and C horizons are dominantly gravelly silt loam or gravelly loam, but 15 to 30 percent of each of these horizons is gravel and 10 to 18 percent of the fine fraction is clay. In areas that have not received lime, reaction is strongly acid or very strongly acid throughout the profile. Thickness of the solum ranges from 25 to 40 inches. Thickness of the alluvium is more than 4 feet.

The B horizon of these soils contains less clay than defined in the range for the Clifty series, but this difference does not alter the usefulness and behavior of these soils.

Clifty soils are near Collins, Belknap, and Waverly soils, but they contain more gravel and are better drained than any of those soils. They contain about the same amount of gravel as Shelocta soils, which are on toe slopes, but they have a weaker developed profile than Shelocta soils and are on flood plains.

Clifty gravelly loam (0 to 2 percent slopes) (Cg).—This soil is in narrow valleys along the upper reaches of streams in Hancock County. It is the only Clifty soil mapped in the survey area. Size of most areas is between 5 and 20 acres.

Included with this soil in mapping were a few areas of Collins soils, a few areas of a moderately well drained gravelly soil, and a few areas of a somewhat poorly drained gravelly soil. Also included were a few areas of a soil that contains more gravel than this Clifty soil.

Erosion is not a hazard, but this Clifty soil is subject to occasional flooding in winter and in spring. Scouring and deposition sometimes occur during periods of flooding, but the deposited material generally is not detrimental to the commonly grown crops.

Some areas of this soil are used to grow corn, tobacco, and hay. Others are in pasture or trees. Capability unit IIs–1; woodland suitability group 1o1.

Collins Series

Deep, moderately well drained, nearly level soils comprise the Collins series. These soils are on flood plains in the central and southern parts of the survey area. They have formed in alluvium derived from loess.

In a represenative profile, the surface layer is dark yellowish-brown silt loam about 7 inches thick. The subsoil is brown, mottled, very friable silt loam in the upper part and is mottled brown and grayish-brown, very friable silt loam in the lower part. It is underlain at a depth of about 30 inches by mottled light brownish-gray and brown, very friable silt loam that extends to a depth of 60 inches or more.

Available moisture capacity is high, and permeability is moderate. Natural fertility is also moderate, and the content of organic matter is low. The root zone is deep.

These soils are easy to till and can be tilled throughout a wide range of moisture content without crusting or clodding. Crops grown on them respond well to applications of lime and fertilizer.

Representative profile of Collins silt loam (in Daviess County, 1½ miles northeast of Habit, 2 miles south of Old State Route No. 54, about 1,000 feet east of a paved road, and 30 feet south of a ditch):

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; very friable; many roots; very strongly acid; abrupt, smooth boundary.

B1—7 to 20 inches, brown (10YR 5/3) silt loam; common, fine, faint mottles of light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4); weak, fine, granular structure; very friable; few roots; very strongly acid; clear, smooth boundary.

B2—20 to 30 inches, mottled brown (10YR 5/3) and grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; very friable; very strongly acid; clear, smooth boundary.

Cg—30 to 60 inches, mottled light brownish-gray (10YR 6/2) and brown (10YR 5/3) silt loam; massive; very friable; very strongly acid.

The Ap horizon ranges from dark yellowish brown (10YR 4/4) to brown (10YR 5/3) in color, and it has weak or moderate structure. The B horizon is silt or silt loam. Dominant colors in the B1 horizon are brown (10YR 4/3) to yellowish brown (10YR 5/4). Mottles in the B1 horizon are few or common and are light brownish gray (10YR 6/2) to grayish brown (10YR 5/2) or pale brown (10YR 6/3). The B2 and Cg horizons have colors similar to those of the B1 horizon, except that grayish colors are dominant in some places. The Cg horizon is light gray (10YR 7/1) to dark yellowish brown (10YR 4/4) or brown (10YR 5/3), and it contains grayish and brownish mottles. Reaction throughout the profile is strongly acid or very strongly acid. Thickness of the solum ranges from 20 to 30 inches. Depth to bedrock is more than 10 feet.

The average annual temperature of Collins soils in the survey area is 1 to 2 degrees cooler than the defined range for the series. This difference does not alter the usefulness and behavior of these soils.

Collins soils are near Clifty, Belknap, and Waverly soils. They have a more grayish subsoil than Clifty soils, and they lack the gravel that is typical in Clifty soils. Their subsoil is less grayish than those of the Belknap and Waverly soils. Collins soils are similar to Wilbur and Lindside soils in drainage, but they are more acid than those soils. They contain more silt than Lindside soils.

Collins silt loam (0 to 2 percent slopes) (Co).—This soil is on flood plains near the bases of hills, in narrow places near large streams, or in narrow valleys in hilly areas. It is the only Collins soil mapped in the survey area. Size of the areas is mostly 5 to 40 acres.

Included with this soil in mapping were a few areas of Belknap and Grenada soils, a few areas of a well-drained soil, and a few areas of a soil that has a more sandy subsoil than typical for Collins soils.

This Collins soil is subject to flooding. Because most flooding occurs in winter and in spring, however, damage to crops is generally minor. In fact, the additional sediment added during flooding is likely to benefit crops. A seasonal high water table delays planting in some years. Erosion generally is not a hazard. Therefore, row crops can be grown year after year.

This soil is used mainly for corn, tobacco, soybeans, hay, and pasture (fig. 6). A few areas are in trees, and a few areas are idle. Capability unit I-2; woodland suitability group 1w1.

Elk Series

The Elk series consists of deep, well-drained soils that are nearly level to steep. These soils are on stream terraces, mainly in the northern part of the survey area. They have formed in mixed alluvium deposited by the Ohio and the Green Rivers.

In a representative profile, the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is brown light silty clay loam that is friable in the upper part and is firm in the lower part. It is underlain at a depth of about 36 inches by dark yellowish-brown, friable loam that extends to a depth of 50 inches or more.

Available moistures capacity is high. Permeability is moderate, and the root zone is deep.

Crops grown on these soils respond well to suitable applications of lime and fertilizer.

Figure 6.—Area of Collins silt loam, where red clover and grass hay are being harvested.

Representative profile of Elk silt loam, 2 to 6 percent slopes (in Hancock County, 3 miles northwest of Hawesville, 150 yards west of State Route No. 334, and 150 yards north of a railroad):

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

B1—8 to 12 inches, brown (7.5YR 4/4) light silty clay loam; common, medium, faint mottles of brown (10YR 4/3); weak, coarse, subangular blocky sturcture; friable; very strongly acid; clear, smooth boundary.

B21t—12 to 26 inches, brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; continuous clay films; very strongly acid; gradual, smooth boundary.

B22t—26 to 36 inches, brown (7.5YR 4/4) light silty clay loam; weak, coarse, subangular blocky structure; firm; soft, black stains on ped surfaces; continuous clay films; very strongly acid; gradual, smooth boundary.

C—36 to 50 inches, dark yellowish-brown (10YR 4/4) loam; massive; friable; strongly acid.

The Ap horizon is brown or dark brown (10YR 4/3). The B1 horizon ranges from brown (7.5YR 4/4) to dark yellowish brown (10YR 4/4). In places in the B1 horizon, clay films are in cracks and on the surfaces of peds. The C horizon is dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6), and it is silt loam in some places. Thickness of the solum ranges from 36 to 50 inches. In all areas depth to bedrock is more than 50 feet. The profile has mica flakes throughout in some areas.

Elk soils are adjacent to Wheeling, Sciotoville, Otwell, Weinbach, and Ginat soils. They have less sandy A and B horizons than Wheeling and Sciotoville soils, and they lack the fragipan that is characteristic of Otwell and Sciotoville soils. Elk soils lack the grayish subsoil colors that are typical in the subsoil of Weinbach and Ginat soils. They are similar to the Ashton soils in drainage, but they have a slightly lighter colored surface layer and stronger profile development than those soils.

Elk silt loam, 0 to 2 percent slopes (EkA).—This nearly level soil is on low ridges that are roughly parallel to the Ohio and the Green Rivers. It is in areas that are mostly 400 to 800 feet wide and are 1,000 to 4,000 feet long.

Included with this soil in mapping were a few areas of Ashton, Wheeling, Otwell, and Sciotoville soils. Also included were some areas of a soil that has a darker surface layer than typical for Elk soils, and other areas of a soil that has a more clayey subsoil than typical.

This Elk soil has a very friable surface layer. It is easy to till and can be tilled throughout a wide range of moisture content without crusting or clodding. The content of organic matter is medium, and natural fertility is high. Because erosion is not a hazard, row crops can be grown year after year. Flooding is generally not a hazard, but a few low areas are occasionally flooded by waters of the Ohio and Green Rivers.

This soil is used for corn, tobacco, soybeans, small grain, hay, and pasture. It is at a slightly higher elevation than adjacent soils. As a result, some areas are used as sites for buildings. Capability unit I-3; woodland suitability group 2o1.

Elk silt loam, 2 to 6 percent slopes (EkB).—This gently sloping soil is on low ridges that are mostly parallel to the Ohio and the Green Rivers. Its slopes are mostly convex. The areas are mostly 400 to 600 feet wide and 1,000 to 2,000 feet long. The profile is the one described as representative for the Elk series.

Included with this soil in mapping were a few areas of Ashton, Wheeling, Otwell, and Sciotoville soils. Also

included were a few areas of a soil that has a darker surface layer than typical for Elk soils, and other areas of a soil that has a more clayey subsoil than typical.

This Elk soil has a very friable surface layer. It is easy to till and can be tilled throughout a wide range of moisture content without crusting or clodding. The content of organic matter is medium, and natural fertility is high. Erosion is a hazard. Therefore, effective erosion-control practices are needed if row crops are grown. Flooding is generally not a hazard, but a few low areas are occasionally flooded by waters of the Ohio and Green Rivers.

This soil is used mainly for corn, soybeans, tobacco, small grain, hay, and pasture. It is at a slightly higher elevation than adjacent soils. As a result, some areas are used as sites for buildings. Capability unit IIe-1; woodland suitability group 2o1.

Elk silt loam, 6 to 12 percent slopes (EkC).—This sloping soil is on the sides of narrow ridges in the valley of the Ohio and Green Rivers. The areas are mostly 200 to 500 feet wide and are 1,000 to 2,000 feet long.

Included with this soil in mapping were a few areas of eroded Elk soils in which the surface layer is composed of a mixture of material from the original surface layer and of material from the subsoil. Also included were a few areas of Wheeling and Otwell soils, and areas of a soil that has a darker surface layer than typical for Elk soils.

Most areas of this Elk soil are easy to till and can be tilled throughout a wide range of moisture content. Clods or crusts tend to form in eroded areas, however, if those areas are tilled when too wet or too dry. The content of organic matter is medium, and natural fertility is high. This soil is suited to most crops commonly grown in the survey area, but the hazard of erosion is severe. Effective erosion-control practices are needed if row crops are grown. Flooding is generally not a hazard, but a few low areas are occasionally flooded by waters of the Ohio and Green Rivers.

This soil is used mainly for corn, soybeans, hay, pasture, and trees. Capability unit IIIe-1; woodland suitability group 2o1.

Elk silt loam, 12 to 50 percent slopes (EkE).—This strongly sloping to steep soil is on short side slopes of narrow ridges in the valley of the Ohio River. Most of the slopes are less than 200 feet long.

Included with this soil in mapping were areas of Elk soils that have lost all of their original surface layer through erosion and that have a surface layer that is redder and more clayey than the original one. Also included were a few areas of Wheeling soils.

Most areas of this Elk soil can be tilled throughout a wide range of moisture content without crusting or clodding. Clods or crusts tend to form in eroded areas, however, if those areas are tilled when too wet or too dry. The content of organic matter is medium, and natural fertility is high. Because of the severe hazard of erosion, this soil is not suited to cultivated crops. It can be used for permanent vegetation and is well suited to grasses and legumes grown for hay or pasture. A few low areas are subject to occasional flooding.

This soil is used mostly for hay, pasture, and trees. A few areas are used for row crops. Capability unit VIe-1; woodland suitability group 2o1.

Elk silty clay loam, 6 to 12 percent slopes, severely eroded (ElC3).—This sloping soil is on the sides of long, narrow ridges in the valleys of the Ohio and Green Rivers. The areas are mostly 200 to 500 feet wide and are 1,000 to 2,000 feet long. In places they contain shallow rills and gullies. The profile is similar to the one described as representative for the Elk series, except that all of the original surface layer has been lost through erosion. The present surface layer is brown silty clay loam.

Included with this soil in mapping were a few areas of Wheeling and Otwell soils, and a few areas of a soil that has a more clayey subsoil than does this Elk soil.

Past erosion and the severe hazard of future erosion make this Elk soil unsuitable for frequent cultivation. Because of the clay in the surface layer, tillage can be satisfactorily done only within a narrow range of moisture content without risk of crusting or clodding. The content of organic matter is very low, and natural fertility is moderate. Effective erosion-control practices are needed if cultivated crops are grown. Flooding generally is not a hazard, but a few low areas are occasionally flooded by waters of the Ohio and Green Rivers.

This soil is used mainly for corn, soybeans, hay, pasture, and trees. Capability unit IVe-3; woodland suitability group 3o1.

Frondorf Series

The Frondorf series consists of moderately deep, well-drained soils that are strongly sloping to steep. These soils are on uplands in the southern and eastern parts of the survey area. The have formed in a thin deposit of loess and in material weathered from sandstone and siltstone.

In a representative profile, the surface layer is yellowish-brown silt loam about 7 inches thick. The subsoil is brown, friable silty clay loam to a depth of about 18 inches. Below that depth and extending to a depth of about 24 inches, it is yellowish-brown, mottled, friable gravelly silty clay loam. The substratum is mottled brown and light brownish-gray gravelly silty clay loam. It is underlain by soft sandstone bedrock at a depth of about 30 inches.

Available moisture capacity and permeability are moderate, and the root zone is moderately deep. In areas that have not been limed, the surface layer is very strongly acid.

Representative profile of Frondorm silt loam, 12 to 20 percent slopes (in Daviess County, 4 miles southeast of Habit, one-fourth mile east of the Friendship Church, and 100 feet west of an oil pumphouse):

Ap—0 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; very friable; many roots; very strongly acid; clear, smooth boundary.

B21t—7 to 18 inches, brown (7.5YR 5/4) silty clay loam; strong brown (7.5YR 5/6) if crushed; moderate, very fine, subangular blocky structure; friable; continuous clay films; few roots; strongly acid; gradual, smooth boundary.

IIB22t—18 to 24 inches, yellowish-brown (10YR 5/4) gravelly silty clay loam; common, medium, distinct, light-gray (10YR 7/1) mottles; moderate, very fine, angular blocky structure; friable; 30 percent of horizon is sandstone fragments; patchy clay films on ped surfaces; strongly acid; gradual, smooth boundary.

IIC—24 to 30 inches, mottled brown (7.5YR 4/4) and light brownish-gray (10YR 6/2) gravelly silty clay loam; massive; firm; 30 percent of horizon is sandstone fragments; strongly acid.
R—30 inches, soft sandstone bedrock.

Color of the Ap horizon ranges from yellowish brown (10YR 5/4) to brown (10YR 4/3). In wooded areas the profile contains an A1 horizon of very dark grayish-brown (10YR 3/2) or dark-brown (10YR 3/3) silt loam 1 to 22 inches thick. The B21t horizon is brown (7.5YR 4/4) to strong brown (7.5YR 5/6) or yellowish brown (10YR 5/4). Texture of that horizon is light silty clay loam or heavy silt loam, and structure is fine or very fine, subangular or angular blocky. The IIB22t horizon is gravelly silty clay loam to loam. The IIC horizon is gravelly silty clay loam to sandy loam. Reaction throughout the profile ranges from medium acid to very strongly acid. Thickness of the solum ranges from about 18 to 30 inches. Thickness of the mantle of loess is about 12 to 20 inches. Depth to bedrock ranges from 1½ to 3½ feet.

Frondorf soils are near Wellston, Zanesville, and Shelocta soils. They have a thinner profile and have thinner B horizons than Wellston and Zanesville soils, and they lack the fragipan that is typical in the profile of Zanesville soils. Frondorf soils are similar to the Shelocta soils in texture, but they have a thinner profile than Shelocta soils and are on uplands instead of on toe slopes. In this survey area, Frondorf soils are mapped only in complexes with Wellston soils.

Frondorf-Wellston silt loams, 12 to 20 percent slopes (FwD).—Soils of this mapping unit are on the sides of hills in areas dissected by draws. They have formed in a thin layer of loess and in material weathered from sandstone, siltstone, and shale. The areas range from about 5 to 40 acres in size.

Frondorf soils make up about 45 percent of this mapping unit, Wellston soils about 35 percent, and other soils about 20 percent. The Frondorf soils have the profile described as representative for the Frondorf series. The Wellston soils have a profile similar to the one described as representative for the Wellston series, except that their profile has not been altered by severe erosion and their surface layer is less red.

Included with these soils in mapping were small areas of Zanesville, Shelocta, and Collins soils, and areas of a soil that is shallower over bedrock than typical for Frondorf and Wellston soils. Also included were areas of a soil that has a more sandy subsoil and areas of a soil that has a more clayey subsoil than typical for Frondorf and Wellston soils.

Soils of this mapping unit can be tilled throughout a wide range of moisture content. They can be used for most crops commonly grown in the survey area, but the hazard of erosion is very severe if cultivated crops are grown. Their content of organic matter is low. Frondorf soils have moderately low natural fertility, and Wellston soils have moderate natural fertility. Crops grown on these soils respond well to applications of lime and fertilizer. Needed management practices are ones that reduce runoff and that help to control erosion. Capability unit IVe–2; woodland suitability group 3o1.

Frondorf-Wellston silt loams, 12 to 20 percent slopes, severely eroded (FwD3).—This mapping unit consists of well-drained soils on the sides of hills in areas dissected by draws. These soils have formed in a thin layer of loess and in material weathered from sandstone, siltstone, and shale. The areas range from 5 to 40 acres in size.

Frondorf soils make up about 45 percent of this mapping unit, Wellston soils about 35 percent, and other soils about 20 percent. The Frondorf soils have a profile similar to the one described as representative for the Frondorf series, except that their surface layer is more reddish and they are shallower over bedrock. The profile of the Wellston soils is similar to the one described as representative for the Wellston series.

Included with these soils in mapping were small areas of Zanesville, Shelocta, and Collins soils. Also included were areas of a soil that is shallower over bedrock, areas of a soil that has a more sandy subsoil, and areas of a soil that has a more clayey subsoil than typical for Frondorf and Wellston soils.

Because of past severe erosion and the hazard of future erosion, soils of this mapping unit are better suited to close-growing crops than to crops that require cultivation. They can be used for hay or pasture. Their content of organic matter is very low. The Frondorf soils are low and the Wellston soils are moderately low in natural fertility. Crops grown on these soils respond well to applications of lime and fertilizer. Capability unit VIe–3; woodland suitability group 4o1.

Frondorf-Wellston silt loams, 20 to 30 percent slopes (FwE).—This mapping unit consists of well-drained soils on the sides of hills in areas dissected by draws. These soils have formed in a thin layer of loess and in material weathered from sandstone, siltstone, and shale. The areas range from about 10 to 40 acres in size.

Frondorf soils make up about 48 percent of this mapping unit, Wellston soils about 32 percent, and other soils about 20 percent. Both the Frondorf and Wellston soils have a profile similar to the one described as representative for their respective series, except that the Wellston profile has not been altered by severe erosion and the surface layer is less reddish. Also, some stones are on the surface and rock crops out in places.

Included with these soils in mapping were small areas of Zanesville, Shelocta, and Collins soils. Also included were areas of a soil that is shallower over bedrock, areas of a soil that has a more sandy subsoil, and areas of a soil that has a more clayey subsoil than typical for Frondorf and Wellston soils.

Soils of this mapping unit have a low content of organic matter. The Frondorf soils have moderately low natural fertility, and the Wellston soils have moderate natural fertility. Because these soils are subject to erosion, they are better suited to permanent vegetation than to crops that require cultivation. They are suited to hay and pasture. Crops grown on them respond to applications of lime and fertilizer. Capability unit VIe–2; woodland suitability group 3r1 and 4r1.

Frondorf-Wellston silt loams, 20 to 30 percent slopes, severely eroded (FwE3).—This mapping unit consists of well-drained soils on the sides of hills and in dissected areas. These soils have formed in a thin layer of loess and in material weathered from siltstone, sandstone, and shale. Size of individual areas ranges from 10 to 40 acres.

Frondorf soils make up about 60 percent of this mapping unit, and Wellston soils about 40 percent. Both the Frondorf and Wellston soils have a profile similar to the one described as representative for their respective series. The surface layer of the Frondorf soils is reddish, how-

ever, and the profile is shallower over bedrock. Also, a few stones are on the surface and rock crops out in places.

Included with these soils in mapping were small areas of Zanesville, Shelocta, and Collins soils. Also included were areas of a soil that is shallower over bedrock, areas of a soil that has a more sandy subsoil, and areas of a soil that has a more clayey subsoil than typical for Frondorf and Wellston soils.

Soils of this mapping unit have a very low content of organic matter and low or moderately low natural fertility. Because of past severe erosion and the hazard of further erosion, they are unsuitable for cultivated crops. Grasses and legumes can be grown, to a limited extent, for hay or pasture, and these soils are well suited to trees. Capability unit VIIe-2; woodland suitability group 4r1.

Frondorf-Wellston silt loams, 30 to 50 percent slopes (FwF).—This mapping unit consists of well-drained soils on the sides of hills and in highly dissected areas. These soils have formed in a thin layer of loess and in material weathered from sandstone, siltstone, and shale. The areas range from about 10 to 50 acres in size.

Frondorf soils make up about 50 percent of this mapping unit. Wellston soils about 30 percent, and other soils about 20 percent. Both the Frondorf and Wellston soils have a profile similar to the one described as representative for their respective series, except that severe erosion has not altered the profile of the Wellston soils and the Wellston surface layer is less reddish. In places about 1 to 5 percent of the surface is covered with stones that are mostly 1 to 2 feet in diameter. In some areas there are also rock outcrops and rock escarpments.

Included with these soils in mapping were small areas of Zanesville, Shelocta, and Collins soils. Also included were areas of a soil that is shallower over bedrock, areas of a soil that has a more sandy subsoil, and areas of a soil that has a more clayey subsoil than typical for Frondorf and Wellston series.

Erosion is a severe hazard, and some areas of this mapping unit are suitable only for trees. Other areas are suitable for hay or pasture. Mowing and cultivating are not practical, however, because of the stones and the outcrops of rock. Capability unit VIIe-1; woodland suitably group 3r1 and 4r1.

Ginat Series

The Ginat series consists of deep, nearly level, poorly drained soils that have a fragipan. These soils are on stream terraces in the northern part of the survey area. They have formed in mixed alluvium deposited by the Ohio River.

In a representative profile, the surface layer is grayish-brown silt loam about 9 inches thick. The subsoil, to a depth of about 20 inches, is light-gray, mottled, very friable silt loam. Below that depth and extending to a depth of about 40 inches, it is a firm, brittle, and compact fragipan of mottled light brownish-gray and yellowish-brown heavy silt loam and mottled light-gray silty clay loam. The fragipan is underlain by a layer of strong-brown, mottled silty clay loam that extends to a depth of 52 inches or more.

Available moisture capacity is moderate, the content of organic matter is low, and natural fertility is moderately low. The root zone is moderately deep. Permeability of the fragipan is slow.

Crops grown on these soils respond well to applications of lime and fertilizer.

Representative profile of Ginat silt loam (in Daviess County, 2 miles southwest of Stanley, 1 mile south of Sauer Road, and 400 feet west of a barn):

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; very friable; few dark-brown concretions; few roots; medium acid; abrupt, smooth boundary.

B2tg—9 to 20 inches, light-gray (10YR 6/1) heavy silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/4); moderate, medium, subangular blocky structure; gray clay films; few brown concretions; few roots; very friable; very strongly acid; clear, smooth boundary.

Bx1—20 to 26 inches, mottled light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/6) heavy silt loam; weak; fine, subangular blocky structure; firm, brittle and compact; patchy, gray clay films; very strongly acid; gradual, smooth boundary.

Bx2—26 to 40 inches, light-gray (10YR 6/1) silty clay loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); weak, fine, subangular blocky structure; firm, brittle and compact; gray clay on ped surfaces and in cracks; strongly acid; gradual, smooth boundary.

C—40 to 52 inches, strong-brown (7.5YR 5/6) silty clay loam; many, coarse, distinct mottles of grayish brown (10YR 5/2); massive; firm; very strongly acid.

Color of the Ap horizon ranges from dark grayish brown (10YR 4/2) to pale brown (10YR 6/3). In places the Ap horizon contains faint, grayish mottles. Dominant colors in the B2tg horizon range from light gray (10YR 7/1) to grayish brown (2.5Y 5/2). Mottles in that horizon range from few to many and are dark brown (10YR 4/3) to yellowish brown (10YR 5/6) or pale brown (10YR 6/3). Texture of the B2tg horizon is heavy silt loam or light silty clay loam, and structure is moderate, medium, subangular blocky to weak, fine, granular. Depth to the Bx horizons, or fragipan, ranges from about 15 inches to 30 inches. The Bx horizons are heavy silt loam or silty clay loam, and they range from light gray (10YR 7/1) or light brownish gray (2.5Y 6/2 to yellowish brown (10YR 5/6) in color. Mottles are very dark grayish brown (2.5Y 3/2). In some places the Bx2 horizon is massive, lacks clay films, and has characteristics of a Cx horizon. The C horizon is silt loam or silty clay loam, and it contains mottles that are grayish or brownish. Reaction throughout the profile ranges from medium acid to very strongly acid. The solum ranges from about 30 inches to 42 inches in thickness. The underlying material is stratified and consists of gravel, sand, silt, and clay. Combined thickness of these layers of underlying material is more than 50 feet.

Ginat soils are near Elk, Otwell, and Weinbach soils of stream terraces and near Newark, Melvin, and Jacob soils of flood plains. Their subsoil is more grayish than those of the Elk, Otwell, Weinbach, and Newark soils, and they have a fragipan that is lacking in the Newark, Melvin, and Jacob soils.

Ginat silt loam (0 to 2 percent slopes) (Gn).—This soil occupies broad, flat areas, where sediment has been deposited by the Ohio River. It is the only Ginat soil mapped in the survey area. Most areas are at a slightly lower elevation than adjacent soils, and small areas are slightly concave. The areas are mostly 500 to 1,500 feet wide.

Included with this soil in mapping were a few areas of Weinbach and Melvin soils, and areas of a soil that is shallow to a fragipan. Also included were areas of a soil containing a weakly developed fragipan that only slightly restricts the growth of roots.

This Ginat soil can be tilled throughout a fairly wide range of moisture content without crusting or clodding. Erosion is not a hazard, but the fragipan restricts the movement of water and the penetration of roots.

This soil is better suited to crops that tolerate wetness than to other kinds of crops. It is used intensively for row crops, but a few inadequately drained areas are in pasture or trees. Capability unit IIIw-3; woodland suitability group 1w2.

Grenada Series

The Grenada series consists of moderately well drained, nearly level or gently sloping, deep soils that have a fragipan. These soils occur in widely scattered areas on uplands throughout most of Daviess and Hancock Counties. They have formed in loess.

In a representative profile, the surface layer is brown silt loam about 7 inches thick. The upper part of the subsoil is yellowish-brown, friable heavy silt loam that extends to a depth of about 16 inches. The next layer is mottled pale-brown and dark yellowish-brown, firm silt loam that extends to a depth of about 22 inches. The lower part of the subsoil is a very firm, very compact and brittle fragipan of mottled yellowish-brown and dark yellowish-brown silt loam. The fragipan is underlain by a layer of mottled yellowish-brown and brown, firm silty clay loam that extends from a depth of about 36 inches to a depth of 50 inches or more.

Available moisture capacity is moderate, the content of organic matter is low, and natural fertility is moderately low. Permeability is moderate above the fragipan and is slow in the fragipan. Roots and water easily penetrate the soil material above the fragipan, but penetration is restricted in the fragipan.

These soils can be tilled throughout a wide range of moisture content without crusting or clodding. Crops grown on them respond well to applications of lime and fertilizer.

Representative profile of Grenada silt loam, 2 to 6 percent slopes (in Daviess County, 2 miles east of Utica, 500 yards north of fork in a paved road, and 50 feet east of a barn):

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; week, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

B2—7 to 16 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, fine, subangular blocky structure; friable; few clay films in large pores; strongly acid; clear, smooth boundary.

B3 and A'2—16 to 22 inches, mottled pale-brown (10YR 6/3) and dark yellowish-brown (10YR 4/4) silt loam; moderate, fine, subangular blocky structure; firm; few clay films; strongly acid; gradual, smooth boundary.

Bx—22 to 36 inches, mottled yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) silt loam; weak, fine, subangular blocky structure; very firm, very compact and brittle; light brownish-gray (10YR 6/2) silt coatings in cracks and on polygons; patchy clay films; strongly acid; gradual, smooth boundary.

C-36 to 50 inches, mottled yellowish-brown (10YR 5/6) and brown (10YR 4/3) silty clay loam; weak, fine, subangular blocky structure; firm; light brownish-gray (2.5Y 6/2) coatings in cracks; medium acid.

Color of the Ap horizon ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/2). The B2 horizon is typically yellowish brown (10YR 5/6), but it is dark yellowish brown (10YR 4/4) or strong brown (7.5YR 5/6) in places. In some areas the B2 horizon is light silty clay loam, and it is medium acid in places. Depth to the Bx horizon, or fragipan, ranges from 20 to 30 inches. The Bx horizon is brown (7.5 YR 4/4) or light gray (10YR 7/2) in some areas, and it is silty clay loam in places. Reaction of the Bx horizon is strongly acid or medium acid. The C horizon is silt loam or silty clay loam, and it ranges from strongly acid to slightly acid in reaction. Thickness of the solum ranges from 34 to 50 inches. Depth to bedrock is more than 6 feet.

The average annual temperature for these soils is 1 or 2 degrees cooler than the defined range for the Grenada series. Also, parts of the A horizon do not extend downward into the B horizon. These differences do not alter the usefulness and behavior of the soils.

Grenada soils are near Memphis, Wellston, Loring, Zanesville, Uniontown, and Calloway soils. They have a fragipan that is lacking in Memphis and Wellston soils, and they have a less reddish subsoil than Loring and Zanesville soils. Grenada soils lack the grayish colors in the upper part of the subsoil that are characteristic in the subsoil of Calloway soils. They have a less clayey subsoil than Uniontown soils and have a fragipan that is lacking in those soils. Grenada soils are similar to Sciotoville and Otwell soils in drainage, but unlike those soils, they have formed in loess.

Grenada silt loam, 0 to 2 percent slopes (GrA).—This nearly level soil is mostly on wide ridgetops or at the bases of steeper slopes in the uplands. Most areas are between 5 and 20 acres in size.

Included with this soil in mapping were a few areas of Calloway, Loring, and Collins soils, and a few areas of a soil that has some sand in the lower part of the profile. Also included were areas of a soil, also moderately well drained, that contains a weakly developed fragipan, which only slightly restricts the penetration of roots and the movement of water.

Excess water is a slight hazard to crops during wet periods, but this Grenada soil is not subject to erosion. It is suited to most crops commonly grown in the survey area. Deep-rooted crops are short lived, however, because development of roots and the movement of water are restricted by the fragipan.

Most areas of this soil are used for corn, tobacco, hay, or pasture (fig. 7). A few areas are idle or in trees. Capability unit IIw-2; woodland suitability group 3o1.

Figure 7.—Cattle feeding on hay in an area of Grenada silt loam, 0 to 2 percent slopes.

Grenada silt loam, 2 to 6 percent slopes (GrB).—This gently sloping soil is mostly at the bases of steeper slopes and on wide ridgetops. The areas are mostly between 5 and 20 acres in size. The profile is the one described as representative for the Grenada series.

Included with this soil in mapping were small areas of Loring, Zanesville, Uniontown, and Collins soils, and a few areas of a soil that has some sand in the lower part of the profile.

This Grenada soil is suited to most crops grown in the survey area, although deep-rooted crops are short lived. Erosion is a moderate hazard. If cultivated crops are grown, some erosion-control practices are needed.

This soil is used mainly for corn, tobacco, hay, and pasture. A few areas are idle or in trees. Capability unit IIe-2; woodland suitability group 3o1.

Gullied Land

Gullied land (Gu) consists of areas so severely eroded that the soil profile has been destroyed, except in small areas between gullies (fig. 8). Gullies, mostly 4 to 6 feet deep, cover more than 30 percent of the acreage. Most areas are 5 to 15 acres. Slopes are generally between 6 and 20 percent. Included with this unit in mapping were areas of Loring, Zanesville, Wellston, and Frondorf soils.

Areas of this mapping unit are so severely dissected that they cannot be crossed with farm equipment ordinarily used in tillage. Without extensive reclamation, the land is not suitable for row crops, meadow, or pasture. Most areas can be used for hay or pasture if they are leveled and graded and if fertilizer is applied. The hay and pasture plants grow between the gullies and in areas where silt has been deposited in and below the gullies.

Most areas of this mapping unit are idle and are being revegetated by wild grasses, weeds, bushes, and scrub trees. Capability unit VIIe-2; woodland suitability group not assigned.

Figure 8.—**Area of Gullied land in which the soil profile has been largely destroyed, and partly weathered sandstone is exposed. An area of Loring silt loam is in the background.**

Henshaw Series

In the Henshaw series are nearly level soils that are deep and somewhat poorly drained. These soils are on stream terraces, where they have formed in alluvium derived from loess. Most of the areas are near the Green River or near other tributaries of the Ohio River.

In a representative profile, the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil, to a depth of about 18 inches, is light olive-brown, mottled, firm light silty clay loam. The next layer is mottled yellowish-brown, olive-brown, and grayish-brown, firm light silty clay loam. This is underlain by a layer of grayish-brown, mottled, friable light silty clay loam at a depth of about 25 inches. The underlying material is light brownish-gray, mottled, friable silt loam that extends from a depth of about 45 inches to a depth of 65 inches or more.

Available moisture capacity is high, and permeability is moderately slow. The content of organic matter is low. Natural fertility is moderate.

Representative profile of Henshaw silt loam (in Daviess County, 5½ miles southwest of Owensboro, 200 yards west of the intersection of Keller Road and Kentucky Highway No. 81, and three-fourths mile south of the village of Rome):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; very friable; common fine roots; medium acid; abrupt, smooth boundary.

B21t—9 to 18 inches, light olive-brown (2.5Y 5/4) light silty clay loam; common, fine, faint, grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure parting to moderate, fine and medium, angular blocky structure; firm; common fine roots, mostly between prisms; thin, nearly continuous clay films on prisms and thin, patchy clay films on blocks; medium acid; clear, smooth boundary.

B22t—18 to 25 inches, mottled yellowish-brown (10YR 5/6), olive-brown (2.5Y 4/4), and grayish-brown (2.5Y 5/2) light silty clay loam; moderate, medium and coarse, prismatic structure parting to moderate, fine and medium, angular blocky structure; firm; few fine roots between prisms; thin, nearly continuous, brown (10YR 4/3) clay films on prisms and thin, patchy clay films on blocks; slightly acid; gradual, smooth boundary.

B3t—25 to 45 inches, grayish-brown (2.5Y 5/2) light silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure; friable; thin, patchy clay films; neutral; gradual, smooth boundary.

Cg—45 to 65 inches, light brownish-gray (2.5Y 6/2) silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable; few small concretions of calcium carbonate; calcareous below a depth of 55 inches; mildly alkaline.

Color of the Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 4/3). In some places the profile contains a B1 horizon of light yellowish-brown (10YR 6/4) silt loam about 2 to 3 inches thick. Dominant colors in the B21t horizon range from olive brown (2.5Y 4/4) to yellowish brown (10Y 5/8). Mottles in that horizon range from few to many and from light brownish gray (2.5Y 6/2) to dark grayish brown (10YR 4/2). The B22t horizon has colors similar to those of the B21t horizon, except that grayish colors are dominant or it contains about an equal number of gray mottles and brown mottles. The B2 horizons are dominantly heavy silt loam or light silty clay loam, but individual horizons in some areas are heavy silty clay loam. Structure of the B horizons is weak or moderate, and it

ranges from fine through coarse and from angular blocky or subangular blocky to prismatic. Reaction of the B horizons ranges from strongly acid to slightly acid. Colors in the C horizon are similar to those in the B horizons, but gray is the dominant color. Reaction of the C horizon ranges from slightly acid to mildly alkaline, and the C horizon is calcareous in places. Thickness of the solum ranges from 40 to 50 inches. Depth to bedrock is more than 20 feet.

Henshaw soils are near McGary and Uniontown soils of stream terraces, and near Belknap and Wakeland soils of flood plains. They have a coarser textured subsoil than McGary soils, and they are more grayish in the upper part of the subsoil than Uniontown soils. Henshaw soils have a more clayey subsoil and have a better developed profile than Belknap and Wakeland soils. They are similar in drainage to the Calloway and Weinbach soils, but they lack the fragipan that is characteristic of those soils.

Henshaw silt loam (0 to 4 percent slopes) (He).—This is the only Henshaw soil mapped in the survey area. It is on stream terraces in broad valleys south of the valley of the Ohio River. Most of the areas are a few feet higher in elevation than the adjacent soils. Size of the individual areas ranges from 5 to 50 acres.

Included with this soil in mapping were a few areas of Uniontown, McGary, and Belknap soils.

This Henshaw soil can be tilled throughout a wide range of moisture content without clodding or crusting. It is well suited to most crops commonly grown in the survey area. The crops respond well to applications of fertilizer and lime, and most crops respond well to improvements in drainage.

This soil is used intensively for cultivated crops. Most areas are used for corn, soybeans, hay, or pasture. Capability unit IIw–3; woodland suitability group 1w1.

Huntington Series

The Huntington series consists of nearly level soils that are deep and well drained. These soils are on flood plains of the Ohio and the Green Rivers in the northern and western parts of the survey area. They have formed in mixed alluvium derived from loess, glacial till, limestone, sandstone, siltstone, and shale.

In a representative profile, the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is dark-brown, friable silt loam to a depth of about 18 inches. Below that depth and extending to a depth of 60 inches or more, it is brown, friable silt loam.

Available moisture capacity is high, and permeability is moderate. The content of organic matter is medium. Natural fertility is very high. The root zone is deep.

Representative profile of Huntington silt loam (in Daviess County, 2 miles north of Stanley, 200 feet northwest of a turn in the road, and 150 feet south of the Ohio River):

Ap—0 to 8 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; very friable; worm casts; mica flakes; mildly alkaline; clear, smooth boundary.

B21—8 to 18 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable; worm casts; mica flakes; mildly alkaline; diffuse, smooth boundary.

B22—18 to 60 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; worm casts; mica flakes; contain a few very thin layers of sand; mildly alkaline.

Color of the Ap horizon ranges from dark brown (10YR 3/3) to very dark grayish brown (10YR 3/2). The B21 horizon ranges from heavy silt loam to light silty clay loam in texture. In some places the B22 horizon has grayish-brown (10YR 5/2), dark yellowish-brown (10YR 4/4), or light-gray (10YR 7/2) mottles in the lower part. In some areas the B22 horizon is light silty clay loam.

Huntington soils are near Ashton, Lindside, and Bruno soils. They are less firm and have a less clayey subsoil than Ashton soils, and they have fewer grayish mottles in the upper part of the subsoil than do Lindside soils. Huntington soils are less sandy than Bruno soils. They are less silty and have darker colors in the upper part of the profile than Wilbur soils. Unlike the Wilbur soils, which have formed in alluvium from loess, Huntington soils have formed in alluvium from mixed materials.

Huntington silt loam (0 to 4 percent slopes) (Hu).—This soil occurs in bands, 200 to 2,000 feet wide, that are parallel to the Ohio River. It is the only Huntington soil mapped in the survey area.

Included with this soil in mapping were a few areas of Lindside and Ashton soils, and a few areas of a soil that is more sandy throughout than typical for Huntington soils. Also included in a few places were areas of a soil that is stratified in the lower part of the subsoil. Other inclusions consist of a soil that is dark brown in the lower part of the subsoil, and areas of a soil that has a subsoil of silty clay loam.

This Huntington soil rarely crusts or clods as the result of tillage. Sediment deposited during flooding in winter does form a thin crust in places, and this crust can reduce soil aeration. Because of flooding in winter, this soil has only limited use for winter cover crops and perennials. It is suited to all the other crops commonly grown in the survey area. Response of crops to fertilizer is variable. Lime is not needed.

This soil is used mainly for row crops. Capability unit I–1; woodland suitability group 1o1.

Jacob Series

Deep, nearly level, poorly drained soils are in the Jacob series. These soils are on flood plains in the northern part of the survey area, mostly in the valley of the Ohio River. They have formed in mixed alluvium.

In a representative profile, the surface layer is grayish-brown silty clay loam about 7 inches thick. Beneath the surface layer and extending to a depth of 50 inches or more is gray, mottled silty clay that is sticky and plastic when wet.

Available moisture capacity is high, permeability is moderately slow, and the content of organic matter is low. Natural fertility is moderate. Except when the water table is high, the root zone is deep.

Crusts and clods tend to form unless these soils are worked only within a fairly narrow range of moisture content. Crops grown on them respond well to applications of fertilizer and lime.

Representative profile of Jacob silty clay loam (in Hancock County, 3 miles northwest of Hawesville, 100 yards west of State Route No. 334, and 200 yards south of the railroad that leads to Big Rivers powerplant):

Ap—0 to 7 inches, grayish-brown (2.5Y 5/2) silty clay loam; weak, fine, granular structure; friable; strongly acid; clear, smooth boundary.

B21g—7 to 24 inches, gray (10YR 6/1) silty clay; many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, coarse, subangular blocky structure; sticky and plastic; few brown concretions; common pressure faces; strongly acid; diffuse, smooth boundary.

B22g—24 to 40 inches, gray, (10YR 6/1) silty clay; common, fine, distinct mottles of yellowish brown (10YR 5/6) and common, medium, distinct mottles of light olive brown (2.5Y 5/4); moderate, coarse, subangular blocky structure; sticky and plastic; common pressure faces; strongly acid; diffuse, smooth boundary.

C—40 to 50 inches, gray (10YR 6/1) silty clay; many, medium, distinct mottles of strong brown (7.5YR 5/6); weak, coarse, subangular blocky structure; sticky and plastic; strongly acid.

Dominant colors of the B horizons range from dark gray (10YR 4/1) to light brownish gray (2.5Y 6/2). Mottles in the B horizons range from yellowish brown (10YR 5/6) or light olive brown (2.5Y 5/4) to strong brown (7.5YR 5/6). The range of colors in the C horizon is similar to that of the B horizons. In places the C horizon is clay, and it is structureless (massive) in some areas. Reaction throughout the profile is strongly acid or very strongly acid. The solum ranges from 30 to 45 inches in thickness. Depth to bedrock is more than 50 feet.

Jacob soils are near Melvin, Newark, and Ginat soils, but they are more clayey than any of those soils. The upper part of their subsoil is more grayish than that of the Newark soils, and they lack the fragipan of Ginat soils. Jacob soils are similar to Waverly soils in drainage, but they are more clayey than those soils. Jacob soils are more acid and have less clay throughout the profile than Karnak soils of slack water areas.

Jacob silty clay loam (0 to 2 percent slopes) (Ja).—This is the only Jacob soil mapped in the survey area. It is on flood plains, between low ridges that are parallel to streams. The areas are long and are about 200 to 400 feet wide. Size of most areas is 20 to 50 acres.

Included with this soil in mapping were some areas of Melvin, Newark, and Ginat soils, and a few areas of a soil that has a darker surface layer and that contains more sand than typical for Jacob soils. Also included were areas of a soil that has a subsoil and a substratum of silty clay loam, and areas of soil that has a medium acid subsoil.

Flooding is a hazard, and the water table is high during wet periods. Therefore, this Jacob soil is not suited to uses for which a well-drained soil is required. Drainage is needed if most of the common farm crops are to be grown, and it is also needed to allow earlier planting in spring. Because erosion is not a hazard, cultivated crops can be grown year after year.

This soil is used mainly for corn and soybeans (fig. 9). A few areas that have not been adequately drained are in trees. Capability unit IIIw-1; woodland suitability group 1w2.

Karnak Series

The Karnak series consists of clayey soils that are nearly level, deep, and poorly drained. These soils are on wide flood plains, mostly in the central part of Daviess County. They have formed in alluvium in slack water areas along tributaries of the Ohio River.

In a representative profile, the surface layer is dark grayish-brown silty clay that is sticky and plastic when wet. It is about 10 inches thick. The subsoil and the underlying material, to a depth of 50 inches or more, consist of gray, mottled clay that also is very sticky and plastic when wet.

Available moisture capacity and natural fertility are high, and the content of organic matter is low. Permeability is slow. The root zone is deep, except where its depth is limited by a high water table that is near the soil surface during wet periods.

Representative profile of Karnak silty clay (in Daviess County, 1 mile south of Sutherland and 50 feet east of a railroad):

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silty clay; weak, fine, granular structure; sticky and plastic; many roots; few worm casts; medium acid; clear, smooth boundary.

B21g—10 to 24 inches, gray (10YR 6/1) clay; common, medium, distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); moderate, fine, angular blocky structure; very sticky and plastic; few roots; many pressure faces; cracks and pores filled with gray clay; medium acid; diffuse, smooth, boundary.

B22g—24 to 36 inches, gray (10YR 6/1) clay; common, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, angular blocky structure; very sticky and plastic; many pressure faces; cracks and pores filled with gray clay; slightly acid; diffuse; smooth boundary.

Cg—36 to 50 inches, gray (N 6/0) clay; common, medium, distinct mottles of yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2); massive; very sticky and plastic; many pressure faces; cracks and pores filled with gray clay; few, soft, brown concretions; neutral.

Dominant colors in the B horizon range from gray (10YR 6/1) to grayish brown (2.5Y 5/2). Mottles in that horizon are common or many and range from strong brown (7.5YR 5/8) to yellowish brown (10YR 5/6). In places the B horizon is silty clay. Reaction of that horizon is medium acid or slightly acid. Dominant colors of the C horizon are light gray (N 6/0) to grayish brown (2.5Y 5/2), and mottles in that horizon range from strong brown (7.5Y 5/8) to light olive brown (2.5Y 5/4). In places the C horizon is silty clay. Reaction of the C horizon ranges from slightly acid to mildly alkaline. The solum ranges from 30 to 45 inches in thickness. Thickness of the alluvium is 20 feet or more.

Karnak soils are near Markland, McGary, Henshaw, Wakeland, Melvin, Waverly, and Montgomery soils. They are more grayish than Markland, McGary, and Henshaw soils, and they lack the abrupt increase in clay content in the subsoil that is typical in the profiles of those soils. Their texture is finer throughout the profile than that of Wakeland, Melvin, and Waverly soils. They are also more grayish than Wakeland soils and are less acid than Waverly soils. Karnak soils have a thinner, lighter colored surface layer than Montgomery soils, which also formed in slack water sediment. They are similar in drainage to Jacob soils, but they are finer textured and less acid than those soils.

Karnak silt loam, overwash (0 to 2 percent slopes) (Ka).—This soil occurs in wide areas on flood plains, mainly near streams or near the bases of hills. It has received sediment from runoff or from stream overflow. The profile is similar to the one described as representative for the Karnak series, except that the surface layer is brown silt loam about 7 to 15 inches thick. Individual areas range from 20 to 500 acres in size.

Included with this soil in mapping were a few areas of Montgomery soils that have an overwash of silt loam; a few areas of a Karnak soil that has an overwash of sediment 15 to 24 inches thick; and a few areas of a soil that is more acid in the upper part of the subsoil than typical for Karnak soils. Also included were areas of a soil that contains calcium concretions at a depth of about 4 feet.

It can be cultivated throughout a wide range of moisture content without clodding or crusting. This soil is generally not suited to crops that require good drainage.

Figure 9.—**Area of Jacob silty clay loam used to grow soybeans. This poorly drained soil is suited to soybeans if it is adequately drained.**

It is subject to flooding in winter and in spring, but erosion is not a hazard. Therefore, cultivated crops can be grown intensively if drainage is adequate. Crops generally respond well to applications of lime and fertilizer.

This soil is used mostly for row crops and hay. Capability unit IIIw-4; woodland suitability group 1w2.

Karnak silty clay (0 to 1 percent slopes) (Kc).—This soil is mostly in large areas on flood plains. Areas range from 20 to 1,000 acres in size. The profile is the one described as representative for the Karnak series.

Included with this soil in mapping were areas of Karnak soils that have a surface layer of silty clay loam or clay, and a few areas of Montgomery soils.

Because this Karnak soil is sticky and plastic when wet and is hard when dry, it can be satisfactorily worked only within a narrow range of moisture content. It is generally not suited to crops that require good drainage. Flooding occurs in winter and in spring, but erosion is not a hazard. Therefore, cultivated crops can be grown intensively if drainage is adequate. Larger amounts of fertilizer and lime can be applied at less frequent intervals than on more silty soils. Lime is not needed in some areas.

This soil is used mainly for row crops (fig. 10) and hay. A few areas that have not been drained are in trees. Capability unit IIIw-4; woodland suitability group 1w2.

Lakin Series

The Lakin series consists of nearly level soils that are deep and excessively drained. These soils have formed in sandy alluvium on stream terraces in the northern part of the survey area. They are near the Ohio River.

In a representative profile, the surface layer is dark-brown loamy fine sand about 7 inches thick. The subsoil is brown, loose loamy fine sand about 23 inches thick. Beneath the subsoil and extending to a depth of 50 inches or more is a layer of loose sand that is strong brown in the upper part and is yellowish brown in the lower part.

Permeability is rapid, and available moisture capacity is low. The content of organic matter is low. Natural fertility is moderately low.

Figure 10.—**Area of Karnak silty clay used to grow soy beans. Part of the crop has been harvested for grain.**

Representative profile of Lakin loamy fine sand, 0 to 2 percent slopes (in Daviess County, 500 feet west of Stanley School and 50 feet west of a barn):

Ap—0 to 7 inches, dark-brown (10YR 3/3) loamy fine sand; single grained; loose; strongly acid; clear, smooth boundary.

B1—7 to 15 inches, brown (7.5YR 4/4) loamy fine sand; single grained; loose; weak clay bridging; strongly acid; gradual, smooth boundary.

B2t—15 to 30 inches, brown (7.5YR 4/4) loamy fine sand; very weak, fine, subangular blocky structure; loose; a few lumps that show clay bridging and that have a redder hue and higher chroma than the matrix; horizon is slightly less red than the B1 horizon; strongly acid; gradual, smooth boundary.

C1—30 to 45 inches, strong-brown (7.5YR 5/6) sand; single grained; loose; strongly acid; gradual, smooth boundary.

C2—45 to 50 inches, yellowish-brown (10YR 5/4) sand; single grained; loose; strongly acid.

In places the Ap horizon is dark brown (10YR 4/3). The Ap horizon is structureless (single grained) in some areas and has weak, fine, granular structure in others. Consistence of the Ap horizon is loose or very friable. The B horizon is brown (7.5YR 4/4) to strong brown (7.5YR 5/6), and it is strongly acid or very strongly acid. The C horizon ranges from strong brown (7.5YR 5/6) to dark yellowish brown (10YR 4/4) in color and from sand to loamy fine sand in texture. It is strongly acid or very strongly acid. Thickness of the solum ranges from 30 to 38 inches. The material underlying the Lakin soils consists of thin layers of gravel, sand, silt, and clay that have a total thickness of more than 50 feet.

The B horizon of Lakin soils in the survey area lacks the well-expressed lamellae that are within the defined range for the series. This difference does not alter the usefulness and behavior of the soils.

Lakin soils are near Huntington, Lindside, Wheeling, and Elk soils, but they contain more sand than any of those soils. They lack the dark-brown color in the subsoil that is typical in the subsoil of Huntington soils, and they lack the grayish colors in the subsoil that are typical in the subsoil of Lindside soils. In content of sand, Lakin soils are similar to Bruno soils, but they have a better developed profile and have a more reddish subsoil than Bruno soils.

Lakin loamy fine sand, 0 to 2 percent slopes (LaA).—This is the only Lakin soil mapped in the survey area. It is on stream terraces in the valley of the Ohio River. The stream terraces consist mostly of low ridges 400 to 600 feet wide and 800 to 1,000 feet long. Individual areas are mainly 2 to 10 acres in size.

Included with this soil in mapping were a few areas of Wheeling soils, and a few areas of a soil that has gray mottles in the lower part of the subsoil. Also included were areas of a soil that has a dark-brown surface layer, areas of a soil that has a light yellowish-

brown substratum, and areas of a Lakin soil that has slopes of 2 to 6 percent.

Crusts and clods do not form in cultivated areas. Erosion is not a significant hazard, because most of the water from rainfall soaks into the soil and little of it runs off. The loose consistence of the soil material makes traction poor for power equipment needed in farming. Crops grown on this soil respond well to frequent applications of fertilizer and lime.

This soil is used mainly for row crops, hay, and pasture. Capability unit IIIs-1; woodland suitability group 3s1.

Lindside Series

The Lindside series consists of nearly level soils that are deep and are moderately well drained. These soils have formed in alluvium derived from several sources, including limestone, sandstone, siltstone, shale, glacial till, and loess. They are mostly in the northern part of the survey area, on flood plains of the Ohio and Green Rivers.

In a representative profile, the surface layer is brown silt loam about 8 inches thick. The upper part of the subsoil is brown, friable silt loam that is mottled between depths of 17 and 28 inches. The lower part of the subsoil is yellowish-brown, mottled, friable silt loam that extends to a depth of 50 inches or more.

Permeability is moderate. The content of organic matter is also medium, and available moisture capacity and natural fertility are high.

Representative profile of Lindside silt loam (in Daviess County, 2 miles northwest of Birk City, one-half mile north of the Green River, and 200 feet southwest of Hurricane Slough):

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; common fine roots; medium acid; clear, smooth boundary.

B21—8 to 17 inches, brown (10YR 4/3) slit loam; weak, fine, granular structure; friable; few fine roots; medium acid; gradual, smooth boundary.

B22—17 to 28 inches, brown (10YR 5/3) silt loam; common, medium, distinct mottles of grayish brown (10YR 5/2); weak, fine, granular structure; friable; medium acid; gradual, smooth boundary.

B23—28 to 50 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct mottles of grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4); weak, fine, granular structure; friable; strongly acid.

Color of the Ap horizon ranges from brown (10YR 4/3) to dark grayish brown (10YR 4/2) or dark brown (10YR 3/3). Dominant colors in the B21 horizon range from dark brown (10YR 4/3) to yellowish brown (10YR 5/4). In places the B21 horizon contains few or common gray (10YR 6/1) to grayish-brown (10YR 5/2) mottles. The B21 horizon is heavy silt loam to light silty clay loam. Except that grayish colors are dominant in some areas or the horizons contain about equal numbers of grayish and brownish mottles, the B22 and B23 horizons have colors similar to those of the B21 horizon. In places the B22 and B23 horizons are silty clay loam. Reaction throughout the profile ranges from strongly acid to slightly acid. Thickness of the solum ranges from 30 to 55 inches. The alluvium is more than 20 feet thick.

Lindside soils are near Ashton, Elk, and Wheeling soils of stream terraces, and near Huntington and Newark soils of flood plains. They lack the concentration of clay in the subsoil that is typical in the subsoil of Ashton, Elk, and Wheeling soils; and they have a more grayish subsoil than Huntington soils. Lindside soils are less grayish in the upper part of the subsoil than Newark soils. They are similar to Wilbur and Collins soils of loessal areas in drainage, but they are less silty than those and they are less acid than Collins soils.

Lindside silt loam (0 to 2 percent slopes) (Ld).—This is the only Lindside soil mapped in the survey area. It is on flood plains, mainly in long depressions that are mostly 100 to 200 feet wide. This soil lies below areas of well-drained soils on low ridges. It is in areas 2 to 8 acres in size.

Included with this soil in mapping were areas of Huntington and Newark soils; areas of Lindside soils that have a surface layer of loam or silty clay loam; and a few areas of a soil consisting of stratified material. Also included were areas of a soil that has a dark-brown surface layer, and areas of a soil that has light-gray mottles in the subsoil.

This Lindside soil is easy to till and can be tilled throughout a wide range of moisture content. It is suited to most crops commonly grown in the survey area, but in some places susceptibility to flooding limits its use for winter cover crops. Drainage is needed in places to lower the seasonal high water table. Crops respond well to applications of fertilizer. In some areas lime is not needed for most of the commonly grown crops.

Most areas of this soil are used intensively for cultivated crops. Capability unit I-2; woodland suitability group 1w1.

Loring Series

In the Loring series are deep, moderately well drained, nearly level to moderately steep soils that have a fragipan. These soils are on uplands throughout most of the survey area. They have formed in loess.

In a representative profile, the surface layer is dark yellowish-brown silt loam about 7 inches thick. The upper part of the subsoil is brown, friable silty clay loam about 23 inches thick. The lower part of the subsoil is a fragipan of brown, mottled, very firm, brittle and compact silt loam about 24 inches thick. The underlying material is mottled dark yellowish-brown, yellowish-brown, and pale-brown, friable silt loam that extends to a depth of 60 inches or more.

Available moisture capacity is moderate. Permeability is moderate above the fragipan and is slow in the fragipan. Roots and water readily penetrate the soil material above the fragipan, but their further penetration is restricted by the pan.

Representative profile of Loring silt loam, 2 to 6 percent slopes (in Daviess County, one-half mile south of West Louisville in a roadbank along Hobbs Road, 100 feet southwest of an embankment consisting of mine spoil):

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

B2t—7 to 30 inches, brown (7.5YR 4/4) light silty clay loam; strong brown (7.5YR 5/6) if crushed; moderate, fine, subangular blocky structure; friable; many clay films; strongly acid; gradual, smooth boundary.

Bx1—30 to 42 inches, brown (7.5YR 4/4) silt loam; common, medium, distinct mottles of light yellowish brown (2.5Y 6/4) and few, medium, distinct mottles of light brownish gray (10YR 6/2); weak, medium and coarse, subangular blocky structure; very firm, compact and

brittle; patchy clay films; strongly acid; gradual, smooth boundary.

Bx2—42 to 54 inches, mottled brown (7.5YR 4/4) and light-gray (10YR 7/2) silt loam; weak, coarse, subangular blocky structure; very firm, compact and brittle; brownish-yellow (10YR 6/6) clay films in pores; strongly acid; clear, smooth boundary.

C—54 to 60 inches, mottled dark yellowish-brown (10YR 4/4), yellowish-brown (10YR 5/4), and pale-brown (10YR 6/3 silt loam; massive; friable; slightly acid.

Color of the Ap horizon ranges from dark yellowish brown (10YR 4/4) to brown (10YR 4/3 or 5/3) or yellowish brown (10YR 5/4). Texture of the B2t horizon ranges from light silty clay loam to heavy silt loam, and color of that horizon ranges from brown (7.5YR 4/4) to strong brown (7.5YR 5/6). The B horizons are medium acid or strongly acid, and the C horizon is slightly acid to strongly acid. Where these soils have formed in a layer of loess about 4 to 6 feet thick, the fragipan rests on material weathered from sandstone, siltstone, or shale. The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is 6 to 12 feet.

Loring soils in the survey area have an average annual temperature that is 1 to 2 degrees cooler than the defined range for the series. This difference does not alter the usefulness and behavior of these soils.

Loring soils are near Zanesville, Grenada, Memphis, Wellston, and Frondorf soils of uplands, and near Collins, Belknap, and Waverly soils of flood plains. They are deeper over bedrock than Zanesville soils and are more reddish in the upper part of the subsoil than Grenada soils. Loring soils have a fragipan that is lacking in the Memphis, Wellston, and Frondorf soils, and they are deeper over bedrock than Frondorf soils. Their profile is more developed than those of the Collins, Belknap, and Waverly soils, and unlike those soils, they have a fragipan.

Loring silt loam, 0 to 2 percent slopes (LoA).—This soil is mainly in the west-central part of the survey area. It is in areas that are generally at a slightly higher elevation than those occupied by adjacent or nearby soils, which are mostly on flood plains. Included in mapping were a few areas of Memphis, Grenada, and Uniontown soils.

This Loring soil can be worked throughout a wide range of moisture content without clodding or crusting. It has moderate natural fertility but is low in content of organic matter. The compact fragipan in the lower part of the subsoil restricts the penetration of roots and the movement of water. Most crops commonly grown in the survey area can be grown on this soil. Because erosion is not a hazard, cultivated crops can be grown intensively. During wet periods, however, water tends to collect in flat areas. In those places drainage is needed if this soil is to be given its most intensive use. Response is good to applications of fertilizer and lime.

This soil is used mainly for corn and soybeans. Some areas are used for tobacco, hay, and pasture crops. Capability unit I-3; woodland suitability group 3o1.

Loring silt loam, 2 to 6 percent slopes (LoB).—This gently sloping soil is on uplands in the northern, central, and western parts of the survey area. Many of the areas are on the tops of hills, and many of them have an irregular shape. Individual areas range from 5 to 50 acres in size. A profile of this soil is described as representative for the Loring series.

Included with this soil in mapping were a few areas of Memphis, Grenada, and Wellston soils. Also included were a few areas of a Loring soil that has lost all of its original surface layer through erosion and that has a more reddish, more clayey surface layer than the orginal one.

Most crops commonly grown in the survey area can be grown on this Loring soil, but erosion is a moderate hazard. Erosion-control practices are needed if cultivated crops are grown. Roots and moisture easily penetrate to the compact fragipan, but their further penetration is restricted by the pan. Natural fertility is moderate, and the content of organic matter is low. Crops respond well to applications of fertilizer and lime.

This soil is used mostly for row crops, hay, and pasture. On many farms it is also used as a site for the farm buildings. Capability unit IIe-3; woodland suitability group 3o1.

Loring silt loam, 6 to 12 percent slopes (LoC).—This sloping soil is on ridgetops and on the sides of hills in uplands of the northern, central, and western parts of the survey area. Individual areas range from 5 to 30 acres in size.

Included with this soil in mapping were a few areas of Memphis, Wellston, Grenada, Zanesville, and Belknap soils; areas of eroded Loring soils; and areas of a soil that has a more acid subsoil than typical for Loring soils.

Except in some eroded areas, where the plow layer consists mostly of material from the subsoil and is slightly sticky when wet, this Loring soil is easy to till. It has moderate natural fertility but is low in content of organic matter. Movement of air and water is favorable above the moderately deep fragipan. The hazard of erosion is severe, but most crops commonly grown in the survey area can be grown if management is good. Practices that reduce runoff and that help to control erosion are needed in cultivated areas. Crops respond well to applications of fertilizer and lime.

This soil is used mainly for row crops, hay (fig. 11), and pasture. Part of the acreage, mainly in hilly places, is in trees, weeds, or brush. Capability unit IIIe-2; woodland suitability group 3o1.

Loring silt loam, 12 to 25 percent slopes (LoD).—This strongly sloping to moderately steep soil is on hillsides in the northern and western parts of the survey area. Slopes are mostly 200 to 600 feet long. Individual areas range from 10 to 30 acres in size.

Included with this soil in mapping were areas of Memphis, Zanesville, and Wellston soils; areas of eroded Loring soils; and areas of a soil that has a more acid subsoil than typical for Loring soils.

The hazard of erosion makes this Loring soil unsuitable for cultivated crops. Most areas can be worked throughout a wide range of moisture content without crusting or clodding. In eroded areas, however, where the plow layer is composed mainly of material from the subsoil and is slightly sticky when wet, tillage can be satisfactorily done only within a rather narrow range of moisture content. Natural fertility is moderate, and the content of organic matter is low. The upper part of the subsoil is favorable for the penetration of roots and the movement of water, but further penetration or movement is restricted by the fragipan. Crops grown on this soil respond well to applications of fertilizer and lime.

Some areas of this soil have never been cleared. Some areas that have been cleared are used for row crops, hay, or pasture, but others are idle. Most idle areas are revegetating naturally and are returning to forest. Capability unit VIe-1; woodland suitability group 3o1.

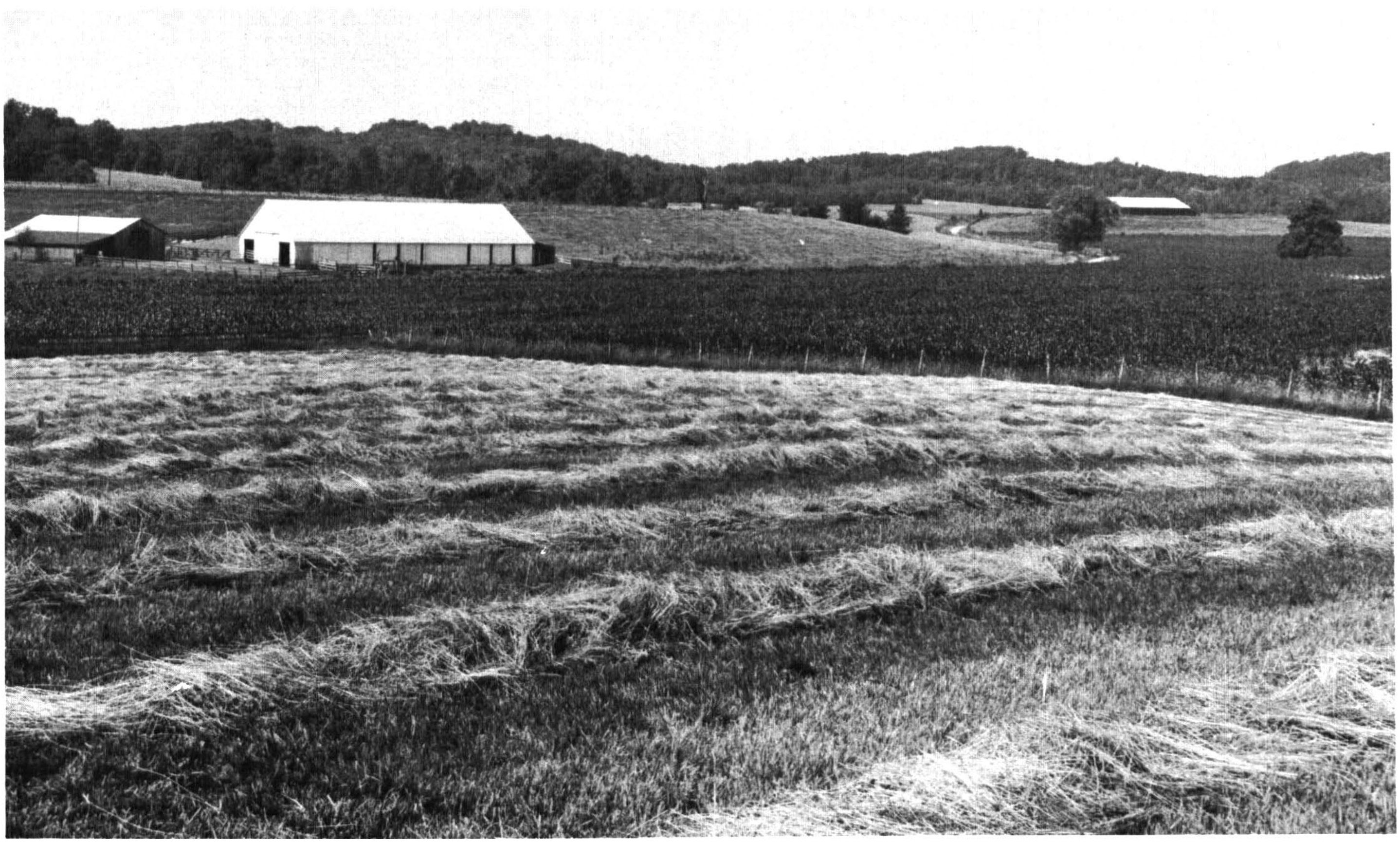


Figure 11.—Areas of Loring silt loam, 6 to 12 percent slopes, and of Belknap silt loam that are used for hay and corn. The Loring soil, in the foreground, is used for hay. The Belknap soil, in the background, is not subject to erosion and is used for corn.

Loring silty clay loam, 6 to 12 percent slopes, severely eroded (LrC3).—This sloping soil is on uplands in Daviess County and in the northern part of Hancock County. It is mostly on hillsides in areas that range from about 10 to 50 acres in size. Erosion has removed all of the original surface layer, and in places it has removed part of the subsoil. The present plow layer is composed of material from the subsoil. It is more reddish and contains more clay than the original one. In some places there are rills and shallow gullies.

Incuded with this soil in mapping were a few areas of Memphis, Zanesville, Grenada, and Wellston soils. Where drainageways occur, areas of Collins or Belknap soils were also included.

This Loring soil is somewhat difficult to till. If it is tilled when too wet, clods or crusts are likely to form. In the most severely eroded places, the root zone is shallow over a fragipan. Movement of water and air are favorable above the fragipan, but movement is restricted in the pan. The content of organic matter is very low, and natural fertility is moderately low. This soil is suited to most crops commonly grown in the survey area, but further erosion is a severe hazard if cultivated crops are grown. In cultivated areas erosion-control practices are needed to prevent excessive erosion.

Some areas of this soil are used for row crops, hay, or pasture, and others are idle. Some idle areas are revegetating naturally and are returning to forest. Capability unit IVe-4; woodland suitability group 4o1.

Loring silty clay loam, 12 to 25 percent slopes, severely eroded (LrD3).—This strongly sloping to moderately steep soil is on hillsides in Daviess County and in the northern part of Hancock County. The areas range from about 5 to 40 acres in size. Slopes are about 200 to 600 feet long. Erosion has removed all of the original surface layer and, in places, part of the subsoil. The present surface layer is more reddish and contains more clay than the original one. In some places there are a few shallow rills and gullies.

Included with this soil in mapping were a few areas of Memphis, Zanesville, and Wellston soils, and areas of a soil that has a more acid subsoil than typical for Loring soils. Where drainageways occur, areas of Collins or Belknap soils were also included.

If this Loring soil is cultivated when too wet, tillage is somewhat difficult and clods and crusts tend to form. In the most severely eroded spots, the root zone is shallow over a fragipan. The content of organic matter is very low, and natural fertility is moderately low. Because of the effects of past erosion and the serious hazard of further erosion, this soil is not suited to cultivated crops. It is suitable for hay, pasture, or trees. Applications of fertilizer and lime are generally beneficial where crops are grown.

Most areas of this soil were formerly cultivated. Now, most of them are used for hay, pasture, or trees, but some are idle. The idle areas are revegetating naturally. Areas that have not been disturbed for several years revert to forest. Capability unit VIe–3; woodland suitability group 4o1.

McGary Series

The McGary series consists of deep, nearly level soils that are somewhat poorly drained. These soils are on stream terraces, where they have formed in alluvium deposited in slack water. They are mostly in the western part of the survey area near the Green River and along other tributaries of the Ohio River.

In a representative profile, the surface layer is brown silt loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part of the subsoil is mottled yellowish-brown and light brownish-gray, friable silty clay loam. The next layer is mottled dark yellowish-brown and light brownish-gray silty clay that is hard when dry and is plastic when wet. The lower part of the subsoil is mottled yellowish-brown and grayish-brown clay that is also hard when dry and plastic when wet. Beneath the subsoil, the underlying material is mottled yellowish-brown and grayish-brown clay that, like the subsoil, is hard when dry and plastic when wet. This underlying material extends to a depth of 50 inches or more.

Available moisture capacity is high, and permeability is slow. The content of organic matter is low or very low. Natural fertility is low or moderately low.

Represenative profile of McGary silt loam (in Daviess County, 4 miles west of St. Joseph and one-half mile southwest of the junction of McCarthy Road and Smock Road, near the end of a farm road):

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; strongly acid; clear, smooth boundary.

B21t—7 to 15 inches, mottled yellowish-brown (10YR 5/6) and light brownish-gray (2.5Y 6/2) silty clay loam; moderate, fine, subangular blocky structure; friable; few clay films; medium acid; gradual, smooth boundary.

B22t—15 to 36 inches, mottled dark yellowish-brown (10YR 4/4) and light brownish-gray (2.5Y 6/2) silty clay; moderate or strong, medium, angular blocky structure; hard and plastic; black concretions; light brownish-gray (2.5Y 6/2) clay films on ped surfaces; strongly acid; diffuse, smooth boundary.

B3—36 to 45 inches, mottled yellowish-brown (10YR 5/4) and grayish-brown (2.5Y 5/2) clay; weak, very fine, angular blocky structure; hard and plastic; black concretions; neutral; diffuse, smooth boundary.

C—45 to 50 inches, mottled yellowish-brown (10YR 5/6) and grayish-brown (2.5Y 5/2) clay; massive; hard and plastic; few black concretions; mildly alkaline.

Color of the Ap horizon ranges from brown (10YR 5/3) to grayish brown (10YR 5/2). Color of the B horizons ranges from light brownish gray (2.5Y 6/2) to yellowish brown (10YR 5/6) or dark gray (10YR 4/1). In places the B21t horizon is silty clay, and in some areas the B22t horizon is clay. The range of colors in the C horizon is similar to that in the B horizons. In many places the C horizon contains concretions of calcium carbonate. The solum ranges from 38 to 50 inches in thickness. The sediment in which these soils have formed is more than 10 feet thick.

McGary soils are near Markland, Uniontown, Henshaw, and Calloway soils. They have grayish colors in the upper part of their subsoil that are lacking in the subsoil of Markland and Uniontown soils, and they have a more clayey subsoil than Uniontown and Henshaw soils. McGary soils have a more clayey subsoil than Calloway soils, and they lack the fragipan that is characteristic of Calloway soils.

McGary silt loam (0 to 4 percent slopes) (Mc).—This is the only McGary soil mapped in the survey area. It is on wide flat-topped stream terraces along major tributaries of the Ohio River. Most areas are a few feet higher in elevation than areas of adjacent soils. The areas range from about 5 to 30 acres in size.

Included with this soil in mapping were a few small areas of Markland and Henshaw soils; a few areas of McGary silty clay loam, eroded; and a few areas of a soil that is wetter than typical for McGary soils. Also included were areas of a soil that is less grayish in the upper part of the subsoil than typical for McGary soils.

Except in eroded areas, where tillage is somewhat difficult, this McGary soil can be worked throughout a fairly wide range of moisture content without clodding or crusting. Surface drainage is needed in most places, but erosion is generally not a hazard. Cultivated crops can be grown year after year without risk of erosion.

This soil is used mainly for corn, soybeans, hay, and pasture. A few areas are in trees. Capability unit IIIw–2; woodland suitability group 3w1.

Markland Series

In the Markland series are deep, nearly level to moderately steep soils that are moderately well drained or well drained. These soils are along tributaries of the Ohio River, mostly in the western part of the survey area. They have formed in sediment deposited in slack water.

In a representative profile, the surface layer is mottled grayish-brown and brown silt loam about 9 inches thick. The subsoil, about 31 inches thick, is yellowish-brown clay that is mottled in the upper part and is plastic when wet and is hard when dry. The underlying material is also yellowish-brown clay that is plastic when wet and is hard when dry. It extends to a depth of 50 inches or more.

The root zone is deep. Permeability is slow.

Representative profile of Markland silt loam, 0 to 2 percent slopes (in Daviess County, 2 miles west of St. Joseph and 400 feet north of the intersection of Smock Road and McCarthy Road):

Ap—0 to 9 inches, mottled grayish-brown (10YR 5/2) and brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

B21t—9 to 20 inches, yellowish-brown (10YR 5/4) clay, yellowish brown (10YR 5/6) if crushed; common, fine, faint mottles of pale brown (10YR 6/3); moderate, fine, subangular blocky structure; plastic when wet and hard when dry; thin clay films; strongly acid; gradual, smooth boundary.

B22t—20 to 26 inches, yellowish-brown (10YR 5/6) clay; common, medium, distinct mottles of grayish brown (2.5Y 5/2); moderate, fine and medium, angular blocky structure; plastic when wet and hard when dry; strongly acid; gradual, smooth boundary.

B23t—26 to 40 inches, yellowish-brown (10YR 5/4) clay; strong, medium, angular blocky structure; plastic when wet and hard when dry; cracks, pores, and spaces between peds filled with gray (10YR 5/1) clay; many, soft, black concretions in upper part of horizon; slightly acid; gradual, smooth boundary.

C—40 to 50 inches, yellowish-brown (10YR 5/6) clay; moderate, medium, angular blocky structure; plastic when wet and hard when dry; cracks and pores filled with gray (10YR 5/1) clay; moderately alkaline and calcareous.

In some places the profile contains an A2 horizon of grayish-brown (10YR 5/2) silt loam. The B21t horizon is yellowish brown (10YR 5/6) to dark yellowish brown (10YR 4/4), and it is silty clay in places. Color of the matrix of the B22t, B23t, and C horizons ranges from light olive brown (2.5Y 5/6) to brown (10YR 4/3). Mottles in those horizons are grayish brown (2.5Y 5/2) to dark gray (10YR 4/1) or light brownish gray (2.5Y 6/2). In some areas the B22t, B23t, and C horizons are silty clay. Concretions of calcium carbonate are at a depth of about 4 feet in some areas. The solum ranges from about 20 to 40 inches in thickness. The sediment in which these soils formed is more than 10 feet thick.

Markland soils are near McGary, Henshaw, and Uniontown soils. They lack the grayish colors in the upper part of the subsoil that are typical in the subsoil of the McGary and Henshaw soils. Their subsoil is finer textured than those of the Uniontown and Henshaw soils.

Markland silt loam, 0 to 2 percent slopes (MdA).—This nearly level soil is on wide flat-topped stream terraces, mostly in the western part of the survey area. Most areas are a few feet higher in elevation than areas of adjacent soils. The profile is the one described as representative for the Markland series.

Included with this soil in mapping were a few areas of Uniontown and McGary soils. Also included were areas of a soil that is more acid in the upper part of the subsoil than typical for Markland soils.

This Markland soil is suited to most crops grown in the survey area. It can be tilled throughout a wide range of moisture content without clodding or crusting. Natural fertility is moderately low, the content of organic matter is low, and available moisture capacity is high. Erosion is not a hazard, and cultivated crops can be grown intensively. Open ditches or diversions are needed in a few places to eliminate excess surface water. Crops respond to applications of fertilizer and lime.

This soil is used mostly for row crops, hay, and pasture. Capability unit IIs–2; woodland suitability group 2c1.

Markland silt loam, 12 to 30 percent slopes (MdE).—This strongly sloping to moderately steep soil is on short side slopes of stream terraces. It is bounded on one side by nearly level soils on top of the terraces. On the other side, it is bounded by nearly level soils on lower lying flood plains.

Included with this soil in mapping were a few areas of eroded Markland soils, and a few areas of Uniontown soils.

This Markland soil can be worked throughout a wide range of moisture content without clodding or crusting. It is low in content of organic matter, however, and is moderately low in natural fertility. Available moisture capacity is high, but much of the moisture from rainfall is lost through rapid runoff. As a result, crops are damaged by lack of moisture during periods of drought. The hazard of erosion is severe. Therefore, this soil is unsuitable for cultivated crops, but most areas are suited to hay, pasture, or trees. A few areas are steep enough to make the use of farm machinery difficult.

Many areas of this soil that are in trees have never been cultivated. Some areas are used for hay or pasture, and other areas are idle. Capability unit VIe–1; woodland suitability group 2c1.

Markland silty clay loam, 2 to 6 percent slopes, eroded (MeB2).—This gently sloping soil is mostly near the edges of stream terraces. It is adjacent to soils of the flood plains, but is a few feet higher in elevation. The surface layer is brighter colored and contains more clay than the one in the profile described as representative for the Markland series. The plow layer is composed of a mixture of material from the original surface layer and the subsoil.

Included with this soil in mapping were a few areas of a Markland soil that is not eroded and that has a profile similar to the one described as representative for the Markland series. Also included were a few areas of Uniontown and McGary soils.

Uneroded areas of this Markland soil can be tilled throughout a wide range of moisture content without crusting or clodding, but the eroded areas tend to clod or crust if they are tilled when too wet. Natural fertility is moderately low, the content of organic matter is low, and available moisture capacity is moderate. Although the root zone is deep, the clayey subsoil is not well suited to the growth of roots. This soil can be used for most of the crops commonly grown in the survey area, but further erosion is a severe hazard. If cultivated crops are grown, effective erosion-control practices are needed. Crops grown on this soil respond to applications of fertilizer and lime.

This soil is used mainly for row crops, hay, and pasture. Capability unit IIIe–1; woodland suitability group 2c1.

Markland silty clay, 6 to 12 percent slopes, severely eroded (MfC3).—This sloping soil is on the sides of stream terraces. On the upper side, it is bounded by nearly level soils on top of the terraces. On the lower side, it is bounded by nearly level soils on flood plains. All of the original surface layer has been lost through erosion, and the present surface layer is composed mostly of material from the subsoil. In places erosion has also removed the subsoil and the calcareous substratum is exposed. The present surface layer is brighter colored and more clayey than the one in the profile described as representative for the Markland series.

Included with this soil in mapping were areas of an uneroded Markland soils that has a profile similar to the one described as representative for the Markland series. Also included were areas of Uniontown soils.

Because of the effects of past erosion and the very severe hazard of future erosion, this Markland soil generally is not suited to cultivated crops. It can be satisfactorily tilled only within a narrow range of moisture content. Crusts and clods tend to form if the soil is tilled when too wet or too dry. The content of organic matter is very low, natural fertility is low, and available moisture capacity is moderate. In most places reaction of the surface layer is strongly acid, but in the most severely eroded places, it is alkaline. Crops grown on this soil respond to applications of fertilizer, but response to lime is variable.

Most areas of this soil are used for hay, pasture, or trees to which this soil is suited. A few areas are used for row crops or are idle. Most of the acreage was formerly cultivated. Capability unit VIe–3; woodland suitability group 3c1.

Markland silty clay, 12 to 30 percent slopes, severely eroded (MfE3).—This strongly sloping to moderately steep soil is on short side slopes of stream terraces. On the upper side, it is bounded by nearly level soils on top of the terraces. On the lower side, it is bounded by nearly level soils on flood plains. Areas at the toes of slopes are subject to flooding in some places. All of the original surface layer has been lost through erosion. In places erosion has also removed all of the subsoil and the calcareous substratum is exposed. The present surface layer is brighter colored and contains more clay than the one in the profile described as representative for the Markland series.

Included with this soil in mapping were a few areas of Uniontown soils.

This Markland soil has a surface layer that is sticky and plastic when wet and is hard when dry. Clods tend to form unless this soil is cultivated only when the content of moisture is nearly ideal. The content of organic matter is very low, and natural fertility is low. Because much of the moisture from rainfall is lost through rapid runoff, crops are damaged from lack of moisture during dry periods. Past erosion and the very severe hazard of further erosion make this soil unsuitable for cultivated crops. Most areas can be used for hay or pasture (fig. 12), but a few of the steepest areas are better suited to trees.

Most of the acreage were formerly cultivated. Now, most areas are used for hay, pasture, or trees. Some areas are idle and are revegetating naturally. Capability unit VIIe-2; woodland suitability group 3c1.

Melvin Series

The Melvin series consists of nearly level, deep soils that are poorly drained. These soils are on flooded plains, mostly in the valley of the Ohio River, in the northern part of the survey area. They have formed in deposits of mixed alluvium that probably was derived from limestone, sandstone, siltstone, shale, glacial till, and loess.

In a representative profile, the surface layer is brown silt loam about 8 inches thick. The subsoil is gray, mottled, very friable heavy silt loam about 16 inches thick. The underlying material is gray, mottled, very friable silt loam that extends to a depth of 50 inches or more.

Available moisture capacity is high, permeability and natural fertility are both moderate, and the content of organic matter is low. The root zone is deep.

Representative profile of Melvin silt loam (in Daviess County, 3 miles southeast of Stanley, 1 mile southeast of Griffith Crossing, 200 feet west of a wooded area, and 50 feet north of a ditch):

Figure 12.—**Area of Markland silty clay, 12 to 30 percent slopes, severely eroded, in permanent vegetation.**

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; slightly acid; clear, smooth boundary.

Bg—8 to 24 inches, gray (10YR 5/1) heavy silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/6); weak, fine, granular structure; very friable; slightly acid; gradual, smooth boundary.

Cg—24 to 50 inches, gray (10YR 5/1) silt loam; few, fine, distinct mottles of yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4); massive; friable; slightly acid.

Color of the Ap horizon ranges from brown (10YR 4/3) to grayish brown (10YR 5/2). The dominant colors of the Bg and Cg horizons are dark gray (10YR 4/1) to light gray (2.5Y 7/2). Color of the mottles in those horizons ranges from yellowish brown (10YR 5/6) to brown (10YR 4/3). Dominant texture of the Cg horizon is silt loam to silty clay loam, but that horizon contains thin layers of loam or silty clay in some places. The solum ranges from about 20 to 36 inches in thickness. The alluvium is more than 50 feet thick.

Melvin soils are near Lindside, Newark, Ginat, and Jacob soils. They are grayer in the upper part of the subsoil than Lindside and Newark soils, and they lack the fragipan that is characteristic of Ginat soils. Melvin soils have less clay throughout the profile than Jacob soils. They are similar in drainage to Waverly soils, but they contain more clay and are less acid throughout the profile than those soils.

Melvin silt loam (0 to 2 percent slopes) (Mh).—This is the only Melvin soil mapped in the survey area. It is on flood plains, mostly in long, narrow areas that are between low ridges and are parallel to streams. The areas are mainly about 100 to 200 feet wide.

Included with this soil in mapping were areas of Jacob, Newark, and Ginat soils; some areas of a soil that has a more acid subsoil than typical for Melvin soils; and areas of a soil that contains more silt than typical for Melvin soils. Also included were areas of a Melvin soil that has surface layer of loam or fine sandy loam, and a few areas of a soil in which the soil material is stratified.

This Melvin soil can be worked throughout a wide range of moisture content without crusting or clodding. It has a high water table during wet periods. Drainage is generally necessary for crops to grow well, and this soil is not suited to crops that require good drainage. The hazard of flooding also limits use of this soil for perennial grasses or cover crops in some places. Because erosion is not a hazard, row crops can be grown year after year if suitable drainage is provided. Crops respond well to applications of fertilizer.

This soil is used mainly for corn and soybeans. A few areas are in hay, pasture, or trees. Capability unit IIIw-1; woodland suitability group 1w2.

Memphis Series

Deep, nearly level to very steep, well-drained soils are in the Memphis series. These soils are on uplands in the northern and central parts of the survey area. They have formed in loess.

In a representative profile, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 40 inches. It is brown, friable light silty clay loam in the upper part and is brown, friable heavy silt loam in the lower part. The underlying material is dark yellowish-brown, friable silt loam that extends to a depth of 60 inches or more.

Permeability is moderate, and available moisture capacity is high. The root zone is deep.

Representative profile of Memphis silt loam, 2 to 6 percent slopes (in Daviess County, 3 miles west of Panther, one-half mile south of New Macedonia Church, and 50 feet west of Cleveland Road):

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B21t—9 to 14 inches, brown (7.5YR 4/4) light silty clay loam; moderate, fine, subangular blocky structure; friable; few roots; few clay films; strongly acid; gradual, smooth boundary.

B22t—14 to 34 inches, brown (7.5YR 4/4) light silty clay loam; strong brown (7.5YR 5/6) if crushed; moderate, fine, subangular blocky structure; friable; few roots; common clay films; strongly acid; gradual, smooth boundary.

B3t—34 to 40 inches, brown (7.5YR 4/4) heavy silt loam; dark yellowish brown (10YR 4/4) if crushed; weak, medium, subangular blocky structure; friable; black concretionary stains on some ped surfaces; discontinuous clay films on some peds; strongly acid; gradual, smooth boundary.

C—40 to 60 inches, dark yellowish-brown (10YR 4/4) silt loam; massive; friable; medium acid.

Color of the Ap horizon ranges from dark yellowish brown (10YR 4/4) to brown (10YR 4/3). In wooded areas these soils have a dark-brown A1 horizon 1 to 3 inches thick. Texture of the B21t and B22t horizons is heavy silt loam or light silty clay loam. The B21t and B22t horizons are typically brown (7.5YR 4/4), but their color ranges to strong brown (7.5YR 5/6). The B21t and B22t horizons are very strongly acid to medium acid. In some places the C horizon is yellowish brown (10YR 5/6). Reaction of the C horizon ranges from strongly acid to slightly acid. In some places where these soils have formed in loess thicker than 10 feet, they are underlain by moderately alkaline and calcareous material below a depth of about 10 feet. The solum ranges from 32 to 48 inches in thickness. Depth to bedrock is more than 6 feet.

The average annual temperature of Memphis soils in the survey area is 1 to 2 degrees cooler than the defined range for the Memphis series. This difference does not alter the usefulness or behavior of the soils.

Memphis soils are near Loring, Grenada, and Wellston soils. They are better drained than Loring and Grenada soils, and they lack the fragipan that is characteristic of those soils. Memphis soils are deeper to bedrock than Wellston soils, and they lack the sand in the lower part of their profile that is characteristic of Wellston soils.

Memphis silt loam, 0 to 2 percent slopes (MmA).—This nearly level soil is mainly in the western and northern parts of Daviess County, where it occurs at a slightly higher elevation than adjacent soils. It is on low ridges that commonly are 300 to 500 feet wide and are 1,000 to 2,000 feet long. The areas are mostly 5 to 10 acres in size.

Included with this soil in mapping were a few areas of Uniontown and Loring soils.

This Memphis soil is easy to till and can be tilled throughout a wide range of moisture content without crusting or clodding. It is suited to all the crops commonly grown in the survey area. Natural fertility is moderate, and the content of organic matter is low. Roots and moisture can readily penetrate. Erosion normally is not a hazard. Therefore, cultivated crops can be grown intensively. Crops respond well to applications of lime and fertilizer.

This soil is used for corn, soybeans, hay, and pasture. Because it is at a higher elevation than adjacent soils,

it is also used as sites for buildings. Capability unit I-3; woodland suitability group 2o1.

Memphis silt loam, 2 to 6 percent slopes (MmB).—This gently sloping soil is mainly on ridgetops in the northern and western parts of the survey area. It is mostly in long, winding areas that are 200 to 500 feet wide and are generally 5 to 20 acres in size. The profile of this soil is the one described as representative for the Memphis series.

Included with this soil in mapping were a few areas of eroded Memphis soils. Also included were a few areas of Loring soils.

This Memphis soil can be tilled throughout a wide range of moisture content without clodding or crusting. It has moderate natural fertility but is low in content of organic matter. Erosion is a moderate hazard, but this soil is suited to all the crops commonly grown in the survey area. Crops grown on it respond well to applications of lime and fertilizer. Practices that help to control erosion are needed if cultivated crops are grown intensively.

This soil is used mainly for corn, tobacco, hay, and pasture, but small areas in the hilly part of the survey area are idle or in trees. On many farms this soil is also used as a site for farm buildings. Capability unit IIe-1; woodland suitability group 2o1.

Memphis silt loam, 6 to 12 percent slopes (MmC).—This sloping soil is on the sides of hills in the northern and western parts of the survey area. Slopes are mostly 400 to 800 feet long, and many of them are dissected by drainageways. Individual areas of this soil range from 4 to 20 acres in size.

Included with this soil in mapping were areas of eroded Memphis soils and areas of Loring and Wellston soils. Also included in places dissected by drainageways were areas of Collins and Belknap soils.

This Memphis soil can be tilled throughout a wide range of moisture content without crusting or clodding. It is suited to all the crops commonly grown in the survey area, although erosion is a severe hazard. Natural fertility is moderate, and the content of organic matter is low. Crops respond well to applications of fertilizer and lime. Effective erosion-control practices are needed if cultivated crops are grown.

This soil is used mainly for row crops, hay, pasture, and trees. A few areas are idle. Capability unit IIIe-1; woodland suitability group 2o1.

Memphis silt loam, 12 to 30 percent slopes (MmE).—This strongly sloping to moderately steep soil is in the northern and western parts of the survey area. It is mainly in areas that are 5 to 50 acres in size. Slopes are mostly 300 to 800 feet long. Some slopes are dissected by draws and drainageways.

Included with this soil in mapping were a few areas of Loring, Wellston, and Uniontown soils, and a few areas of eroded Memphis soils. Also included in places dissected by drainageways were areas of Collins and Belknap soils.

The soil can be tilled throughout a wide range of moisture content without crusting or clodding. It has moderate natural fertility and a low content of organic matter. Erosion is too great a hazard for cultivated crops to be grown, but this soil is suited to permanent vegetation of grasses, legumes, and trees. Crops grown on it respond to applications of lime and fertilizer.

This soil is used mainly for hay, pasture, or trees. A few areas that are idle are revegetating naturally and are reverting to forest. Capability unit VIe-1; woodland suitability group 2o1.

Memphis silt loam, 30 to 60 percent slopes (MmF).—This steep or very steep soil is on the sides of hills in the northern and western parts of the survey area. Size of individual areas ranges from 5 to 30 acres. Slopes are 300 to 600 feet long.

Included with this soil in mapping were areas of moderately eroded and severely eroded Memphis soils. Also included were a few areas of Wellston and Uniontown soils.

This Memphis soil has a low content of organic matter, but it has moderate natural fertility and is readily penetrated by roots and water. Nevertheless, the hazard of erosion is too great for this soil to be suitable for cultivated crops. Most areas are not suitable for hay or pasture, because the steep slopes make the use of farm machinery hazardous. This soil is well suited to trees.

Most of the acreage is in trees. A few areas are in pasture. Capability unit VIIe-1; woodland suitability group 2o1.

Memphis silty clay loam, 6 to 12 percent slopes, severely eroded (MnC3).—This sloping soil is on the sides of hills in the northern and western parts of the survey area. It has lost all of its original surface layer through erosion. In places part of the subsoil has also been lost and there are a few shallow rills and gullies. The present surface layer is more reddish and has a higher content of clay than the one in the profile described as representative for the Memphis series. Slopes are mostly between 400 to 800 feet in length. In many places they are dissected by drainageways.

Included with this soil in mapping were a few areas of Loring and Wellston soils. In areas dissected by drainageways, areas of Collins and Belknap soils were also included.

This soil has a plow layer that is slightly sticky when wet. As a result, tillage is somewhat difficult, unless the content of moisture is nearly ideal. Natural fertility is moderately low, and the content of organic matter is very low. The hazard of further erosion is very severe. Therefore, practices that effectively control erosion are needed. If these and other good management practices are used, the crops normally grown in the survey area grow well. Crops respond well to applications of lime and fertilizer.

This soil is used mainly for row crops, hay (fig. 13), and pasture. Some areas are idle and are revegetating naturally. Capability unit IVe-3; woodland suitability group 3o1.

Memphis silty clay loam, 12 to 30 percent slopes, severely eroded (MnE3).—This strongly sloping to moderately steep soil is on the sides of hills in the northern and western parts of the survey area. It is in areas 5 to 20 acres in size. Erosion has removed all of the original surface layer and, in a few places, part of the subsoil. The present surface layer is more reddish and is finer textured than the one in the profile described as representative for the Memphis series. In most places slopes are 300 to 800 feet long and are dissected by drainageways.

Figure 13.—Area of Memphis silty clay loam, 6 to 12 percent slopes, severely eroded, used for growing hay. Hay and other close-growing crops are effective in protecting this soil from further erosion.

Included with this soil in mapping were a few areas of Loring, Uniontown, and Wellston soils. Also included, in places dissected by drainageways, were areas of Collins and Belknap soils.

This Memphis soil has a plow layer that is slightly sticky when wet. As a result, tillage is somewhat difficult, unless the content of moisture is almost ideal. Natural fertility is moderately low, and the content of organic matter is very low. Because of past erosion and the hazard of further erosion, this soil is generally not suited to cultivated crops. It is suited to permanent vegetation of grasses, legumes, or trees. Crops that are grown respond well to applications of lime and fertilizer.

Most areas of this soil were formerly cultivated. Now, most of the acreage is idle or is in hay, pasture, or trees. The idle areas are revegetating naturally. Capability unit VIe-3; woodland suitability group 3o1.

Montgomery Series

The Montgomery series consists of deep, nearly level, very poorly drained soils that have a clayey subsoil. These soils are mostly in the western part of Daviess County along tributaries of the Ohio River. They have formed in alluvium deposited in slack water.

In a representative profile, the surface layer is very dark grayish-brown silty clay loam about 8 inches thick. Below is a layer, also about 8 inches thick, of very dark gray silty clay that is firm when moist and plastic when wet. The subsoil is about 26 inches thick. It is dark grayish-brown, mottled silty clay that is also firm when moist and is plastic when wet. The underlying material, to a depth of 52 inches or more, is mottled grayish-brown and yellowish-brown clay that is plastic when wet.

The root zone is deep, except where its depth is limited by a high water table. Natural fertility is very high. Permeability is slow, and available moisture capacity and the content of organic matter are high.

These soils can be safely worked only when the content of moisture is nearly optimum. They tend to clod and crust if tilled when too wet or too dry.

Representative profile of Montgomery silty clay loam (on a ditchbank in Daviess County, 4 miles southwest of Curdsville, 500 yards east of the Curdsville-Delaware Road, and 50 feet north of a tree):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay loam; weak, fine, granular structure; firm; few roots; slightly acid; clear, smooth boundary.

A1—8 to 16 inches, very dark gray (10YR 3/1) silty clay; few, fine, distinct mottles of yellowish brown (10YR 5/6); weak, fine and medium, angular blocky struc-

ture; firm, plastic, very hard; few roots; slightly acid; gradual, smooth boundary.

B21—16 to 32 inches, dark grayish-brown (10YR 4/2) silty clay; few, fine, distinct mottles of yellowish brown (10YR 5/6) and common, fine, faint mottles of olive brown (2.5Y 4/4); moderate, fine, angular blocky and weak, medium, prismatic structure; firm, plastic, very hard; few roots; pressure faces of dark grayish brown (10YR 4/2); mildly alkaline; gradual, smooth boundary.

B22—32 to 42 inches, dark grayish-brown (2.5Y 4/2) silty clay; many, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, angular blocky structure; plastic, very hard; few roots; pressure faces of dark grayish brown (2.5Y 4/2); mildly alkaline; diffuse, smooth boundary.

C—42 to 52 inches, mottled grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/6) clay; massive; plastic, very hard; few cracks filled with grayish-brown clay; moderately alkaline.

Color of the Ap and A1 horizons ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). Color of the B21 and B22 horizons ranges from dark grayish brown (2.5Y 4/2) to gray (10YR 5/1). Mottles are olive brown (2.5Y 4/4) to yellowish brown (10YR 5/6). In places the C horizon is silty clay. The C horizon has colors similar to those in the B horizon, or it contains about an equal number of grayish and brownish mottles. In some places it contains calcium concretions at a depth of about 60 inches. The solum ranges from 30 to 48 inches in thickness. The alluvium is more than 30 feet thick.

Montgomery soils are near Markland, McGary, Karnak, and Patton soils. They have a thicker, darker surface layer than Markland, McGary, and Karnak soils, and they are finer textured throughout the profile than Patton soils.

Montgomery silty clay loam (0 to 1 percent slopes) (Mo).—This nearly level soil is on stream terraces and flood plains along tributaries of the Ohio River. It is the only Montgomery soil mapped in the survey area. The areas range from 10 to 300 acres in size.

Included with this soil in mapping were areas of a Montgomery soil that has a surface layer of silty clay; small areas of Patton, Karnak, and McGary soils; and areas of a soil that has a dark surface layer that is thicker than typical for Montgomery soils.

Erosion is not a hazard, but artificial drainage is needed to lower the water table for most commonly grown crops. Where drainage is adequate, cultivated crops can be grown intensively. Crops grown on this soil benefit from large applications of a suitable fertilizer. Most of them do not respond to applications of lime.

This soil is used mostly for corn, soybeans, and hay. Capability unit IIIw-4; woodland suitability group 1w2.

Newark Series

The Newark series consists of soils that are deep, nearly level, and somewhat poorly drained. These soils are mostly in the valley of the Ohio River and are in the northern part of the survey area. They have formed in alluvium derived from various sources, including limestone, sandstone, siltstone, shale, glacial till, and loess.

In a representative profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown mottled, very friable silt loam. The lower part is light brownish-gray, mottled, very friable silt loam. The underlying material is mottled, very friable silt loam that is light brownish gray to a depth of about 52 inches and is brown below that depth. It extends to a depth of 60 inches or more.

Available moisture capacity and natural fertility are high, and the content of organic matter is medium. Permeability is moderate. The root zone is deep, except where its depth is limited by a high water table.

Representative profile of Newark silt loam (in Daviess County, 3 miles northwest of Owensboro, one-half mile north of Hawes Park, 1,000 feet south of a railroad, and 400 feet west of Willett Road):

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine granular structure; very friable; many roots; slightly acid; abrupt, smooth boundary.

B21—9 to 15 inches, brown (10YR 5/3) silt loam; many, fine and medium, faint mottles of light brownish gray (10YR 6/2); weak, fine, granular structure; very friable; few roots; few small mica flakes; slightly acid; gradual, smooth boundary.

B22g—15 to 32 inches, light brownish-gray (2.5Y 6/2) silt loam; many, medium, faint mottles of brown (10YR 4/3); weak, medium, subangular blocky structure; very friable; few small mica flakes; slightly acid; gradual, smooth boundary.

C1g—32 to 52 inches, light brownish-gray (2.5Y 6/2) silt loam; common, coarse, distinct, yellowish-brown (10YR 5/4) mottles and common, medium, faint brown (10YR 5/3) and light-gray (10YR 7/2) mottles; massive; very friable; few weakly cemented, small, irregularly shaped accumulations of black and brown manganese and iron; few small mica flakes; slightly acid; gradual, smooth boundary.

C2—52 to 60 inches, brown (10YR 4/3) silt loam; many, medium, distinct mottles of gray (10YR 6/1); massive; very friable; few thin layers of loam and silty clay loam; few weakly cemented irregularly shaped accumulations of black and brown manganese and iron; few small mica flakes; slightly acid.

Color of the Ap horizon ranges from brown (10YR 4/3) to dark grayish brown (10YR 4/2) or dark yellowish brown (10YR 4/4). Dominant colors of the B21 horizon range from brown (10YR 5/3) to dark grayish brown (10YR 4/2) or yellowish brown (10YR 5/4). Grayish mottles in the B21 horizon are common or many. The B22g horizon and the C horizons are dark gray (10YR 4/1) or light brownish gray (2.5Y 6/2) to light gray (2.5Y 7/2) or brown (10YR 4/3), and brownish mottles in the horizons are common or many. Reaction ranges from medium acid to neutral in the B horizon and from medium acid to mildly alkaline in the C horizon. The solum ranges from about 20 to 45 inches in thickness. Thickness of the alluvium is more than 20 feet.

Newark soils are near Huntington, Ashton, Lindside, Melvin, Jacob, and Weinbach soils. They are more grayish in the upper part of the subsoil than Huntington, Ashton, and Lindside soils and are less grayish in the upper part of the subsoil than Melvin and Jacob soils. Newark soils lack the fragipan that is typical in the profile of Weinbach soils. They are similar in drainage but have more clay in the subsoil than Belknap and Wakeland soils of loessal areas. They are also less acid than Belknap soils.

Newark silt loam (0 to 2 percent slopes) (Ne).—This is the only Newark soil mapped in the survey area. It is on flood plains, mainly in the northern part of the survey area, where it has formed in alluvium deposited by the Ohio River. Most areas are long and narrow, and they are adjacent to the streams. Size of individual areas is about 10 to 50 acres.

Included with this soil in mapping were a few areas of Jacob, Lindside, and Melvin soils; a few areas of a soil that has more sand throughout the profile than is typical for Newark soils; and areas of a soil that has more clay throughout the profile than is typical for Newark soils. Other inclusions consist of a few areas of a soil that

has a stratified subsoil, a few areas of a soil that is strongly acid in the lower part of the subsoil, and a few areas of a soil that has a dark-brown plow layer.

This Newark soil is easy to till and can be tilled throughout a wide range of moisture content without clodding or crusting. It is subject to flooding in winter and in spring, but erosion is not a hazard. Drainage makes this soil more suitable for crops, and it permits earlier planting in spring. Crops respond to applications of fertilizer, but lime is not needed in most places for the crops that are commonly grown.

This soil is used mainly for corn and soybeans. A few areas are in hay or pasture. Capability unit IIw-1; woodland suitability group 1w1.

Otwell Series

In the Otwell series are deep, moderately well drained, nearly level and gently sloping soils that have a fragipan. These soils are on stream terraces in the northern part of the survey area. They have formed in alluvium deposited by the Ohio River.

In a representative profile, the surface layer is dark-brown silt loam about 7 inches thick. The upper part of the subsoil is brown and yellowish-brown, friable silt loam that extends to a depth of about 26 inches. The lower part of the subsoil is a firm, brittle, and compact fragipan of brown mottled heavy silt loam that extends to a depth of about 40 inches. The fragipan rests on a firm substratum of brown, mottled heavy silt loam that extends to a depth of 60 inches or more.

Available moisture capacity and natural fertility are moderate, and the content of organic matter is low. Permeability is moderate above the fragipan and is slow in the pan. The root zone is moderately deep. Roots and moisture easily penetrate the soil material above the fragipan, but their further penetration is restricted by the pan.

These soils can be tilled throughout a wide range of moisture content without crusting or clodding. Crops grown on them respond well to applications of lime and fertilizer.

Representative profile of Otwell silt loam, 0 to 2 percent slopes (in Daviess County, on the south side of Fogle Road, 3 miles southwest of Stanley and 1 mile north of Birk City):

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

B1t—7 to 10 inches, brown (7.5YR 4/4) silt loam; weak, very fine, subangular blocky structure; friable; few thin clay films; few roots; very strongly acid; clear, smooth boundary.

B21t—10 to 19 inches, yellowish-brown (10YR 5/6) silt loam; moderate, fine, subangular blocky structure; friable; few roots; very strongly acid; clear, smooth boundary.

B22t—19 to 26 inches, yellowish-brown (10YR 5/6) silt loam; few, medium, distinct mottles of light brownish gray (10YR 6/2) and a few, fine, faint mottles of brown (7.5YR 4/4); moderate, fine, subangular blocky structure; friable; many, soft, brown concretions; few clay films; few roots; very strongly acid; gradual, smooth boundary.

Bx—26 to 40 inches, brown (10YR 5/3) heavy silt loam; common, medium, distinct mottles of light gray (10YR 6/1) and yellowish brown (10YR 5/8); weak, coarse, prismatic structure that parts to fine, subangular blocky structure; firm, brittle and compact; cracks filled with gray (10YR 5/1) clay; few roots in cracks; very strongly acid; gradual, smooth boundary.

C—40 to 60 inches, brown (10YR 5/3) heavy silt loam; few, fine, faint mottles of light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4); massive; firm; few pressure faces; strongly acid.

In most places the Ap horizon is brown or dark brown (10YR 4/3). The B horizons above the fragipan are typically yellowish brown (10YR 5/6), but their color ranges to brown (7.5YR 4/4) in the upper part or they are strong brown (7.5YR 5/6) throughout. Those horizons are silt loam or light silty clay loam, and the Bx horizon is heavy silt loam or silty clay loam. In places the dominant color of the C horizon is brown (7.5YR 4/4). The solum ranges from 35 to 48 inches in thickness. The alluvium is more than 50 feet thick. These soils are underlain by stratified deposits of gravel, sand, silt,and clay.

Otwell soils are near Elk, Wheeling, Weinbach, and Ginat soils. They have a fragipan that is lacking in Elk and Wheeling soils, and they have less sand throughout the profile than Wheeling soils. Otwell soils lack the grayish colors in the upper part of the subsoil that are characteristic of Weinbach and Ginat soils. They are similar in drainage to Grenada soils, but they contain less silt than those soils. Unlike the Grenada soils, which have formed in loess, they have formed in alluvium.

Otwell silt loam, 0 to 2 percent slopes (OtA).—This nearly level soil is on low ridges that are roughly parallel to the Ohio River. The areas are about 300 to 500 feet wide and are 1,000 to 1,500 feet long. The profile of this soil is the one described as representative for the Otwell series.

Included with this soil in mapping were a few areas of Elk and Weinbach soils, and areas of a soil that has more sand throughout the profile than typical for Otwell soils. Also included were areas of a soil that contains a weakly developed fragipan that is less restrictive to the penetration of roots and to the movement of water than typical of the fragipan in Otwell soils. Other inclusions consist of areas of a soil that has a darker surface layer than typical for Otwell soils.

The hazard of erosion is slight, and cultivated crops can be grown intensively. During wet periods, however, water tends to collect in flat areas. Some low spots are occasionally flooded by waters of the Ohio River.

This soil is used mostly for corn, tobacco, soybeans, small grain, hay, and pasture. Capability unit IIw-2; woodland suitability group 3o1.

Otwell silt loam, 2 to 6 percent slopes (OtB).—This gently sloping soil is on low ridges that are roughly parallel to the Ohio River. The areas are about 300 to 400 feet wide and are 1,200 to 2,000 feet long. They are at a slightly higher elevation than areas occupied by adjacent soils.

Included with this soil in mapping were a few areas of Weinbach and Elk soils and areas of a soil that has more sand throughout the profile than normal for Otwell soils. Also included were areas of a soil that has a less strongly developed fragipan that is less restrictive to the penetration of roots and the movement of water than the fragipan in normal Otwell soils.

The hazard of erosion is moderate. Therefore, practices that help to control erosion are needed if cultivated crops are grown. Some low areas are occasionally flooded by waters of the Ohio River.

This soil is used mostly for corn, tobacco, soybeans, small grain, hay, and pasture. Because it is at a higher elevation than adjacent soils, it is also used as sites for buildings. Capability unit IIe–2; woodland suitability group 3o1.

Patton Series

The Patton series consists of soils that are deep, nearly level, and poorly drained. These soils are mostly in the northern and western parts of the survey area, near upland soils that have formed in loess. They have formed in alluvium that was deposited along tributaries of the Ohio River.

In a representative profile, the surface layer is silt loam about 23 inches thick. The upper part of the surface layer is very dark grayish-brown silt loam and heavy silt loam that is mottled at depths between 7 and 15 inches. The lower part is very dark gray, mottled heavy silt loam. The subsoil, about 9 inches thick, is dark-gray, mottled, friable heavy silt loam. The underlying material is mottled gray and light olive-brown, firm silty clay loam that extends to a depth of 50 inches or more.

The root zone is deep, except where it is restricted by a seasonal high water table. Permeability is moderate, and available moisture capacity is high. Natural fertility is very high.

Crops grown on these soils respond to applications of fertilizer. Lime generally is not needed.

Representative profile of Patton silt loam (in Daviess County, 4 miles west of Owensboro, 100 feet north of Fifth Street Road, and 50 feet west of Lyddane Bridge Road):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; many roots; some partly decayed organic matter; neutral; clear, smooth boundary.

A11—7 to 15 inches, very dark grayish-brown (10YR 3/2) heavy silt loam; few, fine, distinct mottles of yellowish brown (10YR 5/6); weak, fine, granular structure; friable; few roots; slightly acid; gradual, wavy boundary.

A12—15 to 23 inches, very dark gray (10YR 3/1) heavy silt loam; medium, distinct mottles of yellowish brown (10YR 5/6); weak, fine, granular structure; friable; few roots; slightly acid; gradual, wavy boundary.

Bg—23 to 32 inches, dark-gray (10YR 4/1) heavy silt loam; common, medium, distinct mottles of light olive brown (2.5Y 5/4) and a few, fine, distinct mottles of yellowish brown (10YR 5/6); weak, fine, granular structure; friable; few roots; a few very dark gray krotovinas; neutral; gradual, wavy boundary.

Cg—32 to 50 inches, mottled gray (10YR 5/1) and light olive-brown (2.5Y 5/6) silty clay loam; massive; firm; very few roots; neutral.

Color of the Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). The A11 and A12 horizons are black (10YR 2/1) to very dark grayish brown (10YR 3/2). In some places the A12 horizon is absent. The A horizons range from 12 to 24 inches in combined thickness, and they are slightly acid or neutral in reaction. Texture of the A11 and A12 horizons is heavy silt loam or silty clay loam. The Bg and Cg horizons have dominant colors of dark gray (10YR 4/1) to grayish brown (2.5Y 5/2), and they contain mottles that are brown (10YR 5/3) to yellowish brown (10YR 5/6) or olive brown (2.5Y 4/4). The Bg and Cg horizons range from heavy silt loam to silty clay loam in texture and from slightly acid to mildly alkaline in reaction. The solum ranges from 30 to 40 inches in thickness. Thickness of the alluvium is more than 20 feet.

Patton soils are near Uniontown, Henshaw, and Montgomery soils. They have a thicker, darker surface layer than Uniontown, Henshaw, and Melvin soils, and they are less clayey throughout the profile than Montgomery soils.

Patton silt loam (0 to 2 percent slopes) (Pa).—This nearly level soil is on stream terraces and flood plains along tributaries of the Ohio River. It is mainly in the northern and western parts of Daviess County, in areas that are at a slightly lower elevation than those occupied by adjacent soils. Size of most areas is 10 to 20 acres, but a few areas are as large as 500 acres. This soil has the profile described as representative for the Patton series.

Included with this soil in mapping were areas of Henshaw soils. Also included were areas of a soil that has more clay throughout the profile, areas of a soil that is more acid in the upper part of the profile, and areas of a soil that has a thicker dark surface layer than this Patton soil.

This Patton soil has a friable surface layer and can be easily tilled throughout a wide range of moisture content without clodding or crusting. It has a high content of organic matter. Some areas of this soil are subject to flooding in winter and in spring. Cultivated crops can be grown intensively without risk of erosion, but this soil is not suited to crops that require a well-drained soil. Improving drainage would not only make this soil more suitable for crops, but it would also permit earlier planting of most crops in spring.

This soil is used mostly for corn and soybeans. Capability unit IIw–1; woodland suitability group 1w2.

Patton silt loam, overwash (0 to 2 percent slopes) (Ph).—This nearly level soil is on flood plains in the northern and western parts of the survey area. Size of most areas is about 10 to 20 acres. The profile is similar to the one described as representative for the Patton series, except that the surface is covered by an overwash of brown silt loam about 7 to 15 inches thick.

Included with this soil in mapping were some areas of Wakeland and Melvin soils. Also included were areas of a soil that has more sand throughout the profile, areas of a soil that has more clay in the layers below the overwash, and areas of a soil that is more acid in the upper part of the profile than this Patton soil.

This Patton soil can be tilled throughout a wide range of moisture content without crusting or clodding. It has a medium content of organic matter. Erosion is not a hazard. Therefore, row crops can be grown in short rotations without damaging the soil. Crops are sometimes damaged by flooding in winter and in spring. Improved drainage would benefit most crops.

This soil is used mostly for corn and soybeans. Capability unit IIw–1; woodland suitability group 1w2.

Sciotoville Series

The Sciotoville series consists of nearly level or gently sloping, moderately well drained, deep soils that have a fragipan. These soils are on stream terraces, mostly in the valley of the Ohio River in the northern part of the survey area. They have formed in alluvium derived from several different sources. Slopes range from 0 to 6 percent.

In a representative profile, the surface layer is dark-brown loam about 7 inches thick. The upper part of the

subsoil is yellowish-brown, friable loam that extends to a depth of about 27 inches and is mottled between depths of 18 to 27 inches. The lower part of the subsoil is a firm, brittle, and compact fragipan of pale-brown, mottled loam that extends to a depth of about 52 inches. The fragipan rests on a substratum of light brownish-gray, friable loam that extends to a depth of 60 inches or more.

Permeability is moderate above the fragipan and is slow in the pan. Water, air, and roots readily penetrate to the fragipan, but their further penetration is restricted by the pan. Available moisture capacity and natural fertility are both moderate, and the content of organic matter is medium.

These soils can be tilled throughout a wide range of moisture content without crusting or clodding. Crops grown on them respond well to applications of fertilizer and lime.

Representative profile of Sciotoville loam, 0 to 2 percent slopes (in Daviess County, 1½ miles northeast of Sorgho, 300 yards south of Fifth Street Road, and 150 feet east of State Route No. 1554):

Ap—0 to 7 inches, dark-brown (10YR 4/3) loam; weak, fine, granular structure; very friable; many roots; slightly acid; abrupt, smooth boundary.

B21t—7 to 18 inches, yellowish-brown (10YR 5/6) loam; weak, medium, subangular blocky structure; friable; few roots; very strongly acid; gradual, smooth boundary.

B22t—18 to 27 inches, yellowish-brown (10YR 5/4) loam; common, medium, faint mottles of pale brown (10YR 6/3) and dark yellowish brown (10YR 4/4); weak, medium, subangular blocky structure; friable; very strongly acid; clear, wavy boundary.

Bx—27 to 52 inches, pale-brown (10YR 6/3) loam; common, medium, distinct mottles of brown (7.5YR 4/4); massive; firm, brittle and compact; very strongly acid; clear, smooth boundary.

C—52 to 60 inches, light brownish-gray (2.5Y 6/2) loam; massive; friable, very strongly acid.

Color of the Ap horizon ranges from dark brown (10YR 4/3) or brown (10YR 5/3) to dark grayish brown (10YR 4/2). Color of the B horizons above the fragipan is typically yellowish brown (10YR 5/4 or 5/6), but it ranges from light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/8). Mottles in the B22t horizon range from brown (7.5YR 4/4) or strong brown (7.5YR 5/6) to pale brown (10YR 6/3) or light brownish gray (10YR 6/2). The B22t horizon is loam to light silty clay loam, and that horizon has patchy clay films on the surfaces of peds in some places. Mottles in the Bx horizon are gray (10YR 6/1) to strong brown (7.5YR 5/6). The solum ranges from about 36 to 58 inches in thickness. The alluvium is more than 50 feet thick.

Sciotoville soils mapped in this survey area lack the gray mottles in the upper part of the B horizon that are in the defined range for the series. This difference does not alter the usefulness or behavior of the soils.

Sciotoville soils are near Wheeling, Elk, Otwell, and Weinbach soils. They have a fragipan that is lacking in Wheeling and Elk soils, and they contain more sand than Elk and Otwell soils. Sciotoville soils lack the gray colors in the upper part of the subsoil that are typical in the subsoil of Weinbach soils. They are similar in drainage to Grenada soils, but they contain more sand than those soils. Unlike the Grenada soils, which have formed in loess, they have formed in alluvium.

Sciotoville loam, 0 to 2 percent slopes (ScA).—This is the only soil of the Sciotoville series mapped in the survey area. It is on low ridges at a slightly higher elevation than adjacent soils of the flood plains. The ridges are roughly parallel to the Ohio River. In many places they are about 300 to 500 feet wide and are 1,000 to 1,500 feet long. Most areas of this soil are about 10 acres in size.

Included with this soil in mapping were a few areas of Otwell, Wheeling, and Weinbach soils. Also included were areas of a soil containing a weakly developed fragipan that is less restrictive to the penetration of roots and to the movement of water than the fragipan in Sciotoville soils. Other inclusions consist of a soil that has a darker surface layer than Sciotoville soils, and areas of a Sciotoville soil that has slopes of 2 to 6 percent.

Cultivated crops can be grown intensively without risk of erosion. Most of the commonly grown crops are suitable, but deep-rooted plants are short lived. Flooding is a hazard in a few low areas.

This soil is used mostly for corn, tobacco, small grain, hay, and pasture. Capability unit IIw-2; woodland suitability group 3o1.

Shelocta Series

The Shelocta series consists of sloping to moderately steep soils that are deep and well drained. These soils are mainly in the central and southern parts of Hancock County, below areas of soils that are on uplands and that have formed in material weathered from sandstone, siltstone, shale, and loess. They have formed in colluvium derived from these soils of uplands.

In a representative profile, the surface layer is brown silt loam about 7 inches thick. The upper part of the subsoil is dark yellowish-brown or brown, firm gravelly light silty clay loam that extends to a depth of about 34 inches and is mottled between depths of 20 and 34 inches. The lower part of the subsoil is dark yellowish-brown, mottled gravelly silty clay loam. The subsoil extends to a depth of 50 inches or more.

Permeability is moderate, available moisture capacity is high, and the content of organic matter is low. Natural fertility is moderate. The root zone is deep.

Crops grown on these soils respond well to applications of lime and fertilizer.

Representative profile of Shelocta silt loam, 6 to 12 percent slopes (in Hancock County, 2 miles west of Hawesville, 1 mile west of a drive-in restaurant, 200 feet south of U.S. Highway No. 60, and 50 feet east of a barn):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; very friable; many roots; 5 percent of horizon is sandstone pebbles; medium acid; abrupt, smooth boundary.

B21t—7 to 20 inches, dark yellowish-brown (10YR 4/4) gravelly light silty clay loam; moderate, medium, subangular blocky structure; firm; 20 percent of horizon is coarse fragments; clay films; many roots; strongly acid; gradual, smooth boundary.

B22t—20 to 34 inches, mottled dark yellowish-brown (10YR 4/4) and brown (10YR 5/3) gravelly light silty clay loam; moderate, medium, subangular blocky structure; firm; 28 percent of horizon is coarse fragments; few roots; clay films; strongly acid; gradual, smooth boundary.

B23t—34 to 50 inches, dark yellowish-brown (10YR 4/4) gravelly silty clay loam; common, medium, distinct mottles of gray (10YR 6/1); weak, medium, subangular blocky structure; friable; 35 percent of horizon is coarse fragments; clay films; strongly acid.

Color of the Ap horizon is dark brown (10YR 4/3) to brown (10YR 5/3). Dominant colors of the B horizon range from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6). In places the B horizon is very strongly acid, and it is gravelly silt loam in some areas. Coarse fragments, mostly of sandstone, range from 1 to 10 inches in diameter. They comprise 10 to 35 percent of the B horizon.

Shelocta soils are near Frondorf, Wellston, and Zanesville soils of uplands and near Clifty soils of flood plains. They are deeper over bedrock than Frondorf soils, contain more coarse fragments than Wellston and Zanesville soils, and lack the fragipan that is typical in the profile of Zanesville soils. Shelocta soils have a better developed profile than Clifty soils. They are similar in drainage and in degree of profile development to Elk and Wheeling soils, but they contain more coarse fragments than these soils. Also, unlike the Elk and Wheeling soils that have formed in alluvium, they have formed in colluvium.

Shelocta silt loam, 6 to 12 percent slopes (ShC).—This sloping soil is on toe slopes, mostly in areas 5 to 15 acres in size. It is above areas of soils on flood plains and below areas of steeper soils. The profile is the one described as representative for the Shelocta series.

Included with this soil in mapping were a few areas of Clifty, Wellston, and Zanesville soils; a few areas of Shelocta soils that have a surface layer of gravelly silt loam, gravelly loam, or loam; and areas of a Shelocta soil that has some stones on the surface. Also included were areas of a Shelocta soil that has slopes of less than 6 percent.

Tillage can be done throughout a wide range of moisture content without risk of clodding or crusting. In gravelly areas and in areas where stones are in the surface layer, tillage is somewhat difficult. Most crops commonly grown in the survey area grow well, but the hazard of erosion is severe. If cultivated crops are grown, the cropping system should be one that helps to control erosion.

This soil is used mainly for row crops, hay, pasture, and trees. Capability unit IIIe-1; woodland suitability group 2o1.

Shelocta silt loam, 12 to 25 percent slopes (ShD).—This strongly sloping to moderately steep soil is on toe slopes in areas that mostly are 5 to 15 acres in size. It is above areas of soils on flood plains and below areas of steeper soils.

Included with this soil in mapping were a few areas of Clifty, Wellston, and Zanesville soils and a few areas of a Shelocta soil that has some stones on the surface. Also included were areas of Shelocta soils that have a surface layer of loam, gravelly loam, or gravelly silt loam. Other inclusions consist of areas of a severely eroded Shelocta soil that has a more clayey surface layer than the one in the profile described as representative for the Shelocta series.

Where the surface layer is gravelly or where stones are on the surface, tillage is somewhat difficult. This soil can be worked throughout a wide range of moisture content, however, without crusting or clodding. It is suited to most crops grown in the survey area, but the hazard of erosion is very severe if cultivated crops are grown. Where cultivated crops are grown, effective erosion-control practices are needed.

This soil is used mostly for hay, pasture, and trees. A few areas are used for row crops or are idle. Capability unit IVe-1; woodland suitability group 2o1.

Strip Mine Spoil

Strip mine spoil (St) consists of material that has been moved by large earthmoving equipment during the mining of coal. It consists of large piles of soil material, coal, and broken pieces of bedrock in a mixture of variable composition. The degree of slope is variable, but most of the areas are steep. Most are too stony and steep for vehicular traffic, and travel by foot is difficult in some places. A few areas have been leveled. Pits that are left after the coal and overburden have been removed generally hold water. In some pits the water remains toxic to marine life for several years after mining operations have ceased.

In some areas Strip mine spoil contains enough coal, ferrous sulfate, and other toxic material, locally called copperas, to make it toxic to plants for a few years after mining operations have ceased. Most areas, however, can support trees. Some areas can support a sparse growth of grasses and legumes, but mowing and preparation of the seedbed are not practical, except where the areas have been leveled. In leveled areas coarse fragments are a limitation to use of equipment. Capability unit VIIs-1; woodland suitability group not assigned.

Uniontown Series

In the Uniontown series are nearly level to sloping soils that are deep and are moderately well drained or well drained. These soils are on stream terraces in the western and northern parts of the survey area. They have formed in sediment of loessal origin.

In a representative profile, the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil is about 25 inches thick. The upper part of the subsoil is yellowish-brown, friable heavy silt loam; the middle part is yellowish-brown, firm light silty clay loam; and the lower part is light olive-brown, mottled, friable heavy silt loam. The underlying material is grayish-brown, mottled, friable silt loam in the upper part and is light brownish-gray, mottled, very friable silt loam in the lower part. It extends to a depth of 65 inches or more.

Available moisture capacity is high. Permeability is moderate, but the subsoil presents some resistance to the movement of water and the penetration of roots. Most areas of these soils are above the level reached by floodwaters, but a few low areas are subject to occasional flooding.

Representative profile of Uniontown silt loam, 0 to 2 percent slopes (in Daviess County, 4 miles west of Owensboro and 500 feet north of the intersection of Fifth Street and Lyddane Bridge Road):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; few fine roots; neutral; abrupt, smooth boundary.

B21t—9 to 12 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak and moderate, medium, subangular blocky structure; friable; few fine roots; thin, patchy clay films and silt coatings; medium acid; clear, smooth boundary.

B22t—12 to 22 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, prismatic structure parting to moderate, fine and medium, angular blocky structure; firm; few fine roots between prisms; nearly continuous, brown (10YR 4/3) clay films on prisms and blocks; thin, very patchy, black stains on some peds; strongly acid; gradual, smooth boundary.

B23t—22 to 34 inches, light olive-brown (2.5Y 5/4) heavy silt loam; many, medium, faint, yellowish-brown (10YR 5/8) mottles; moderate, coarse, prismatic structure; friable; thin, nearly continuous, brown (10YR 4/3) clay films; few, soft, black concretions of manganese and iron; neutral; gradual, smooth boundary.

C1—34 to 46 inches, grayish-brown (2.5Y 5/2) silt loam; many, medium, faint yellowish-brown (10YR 5/6) mottles; massive; friable; few calcium carbonate concretions 1 millimeter to 2 centimeters in diameter; mildly alkaline; gradual, smooth boundary.

C2—46 to 65 inches, light brownish-gray (2.5Y 6/2) silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/8) mottles; massive; very friable; common calcium carbonate concretions 1 millimeter to 4 centimeters in diameter; calcareous.

Color of the Ap horizon ranges from brown (10YR 4/3) to grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). In some places the profile contains an A2 horizon of grayish-brown (10YR 5/2) silt loam 2 to 5 inches thick. The B horizon is heavy silt loam to silty clay loam. Dominant color of the B horizon is yellowish brown (10YR 5/6), but the colors range from pale brown (10YR 6/3) to olive brown (2.5Y 4/4). Structure of the B horizon is angular blocky, subangular blocky, or prismatic. Reaction is medium acid or strongly acid in the B21t horizon and is slightly acid or neutral in the B23t horizon. The C horizon is grayish brown (2.5Y 5/2) to yellowish brown (10YR 5/6) and is mottled with grayish and brownish colors. Reaction of the C horizon ranges from neutral to moderately alkaline. In many places concretions of calcium carbonate are at a depth of about 4 feet. The solum ranges from 28 to 36 inches in thickness. The alluvium is more than 10 feet thick.

Uniontown soils are near Markland, McGary, Henshaw, Grenada, and Loring soils. They have less clay in their subsoil than Markland and McGary soils, and they lack the grayish colors in the upper part of the subsoil that are typical in the subsoil of McGary and Henshaw soils. Uniontown soils lack the fragipan that is typical in Grenada and Loring soils.

Uniontown silt loam, 0 to 2 percent slopes (UnA).—This nearly level soil occupies areas 5 to 15 acres in size, on broad stream terraces along tributaries of the Ohio River. It is generally bounded on one side by soils at about the same elevation and on the other side by soils at a lower elevation. The profile is the one described as representative for the Uniontown series.

Included with this soil in mapping were a few areas of Henshaw, Belknap, and Grenada soils. Also included were areas of a soil that is more acid in the upper part of the subsoil than this Uniontown soil.

This Uniontown soil has a very friable surface layer and is easy to till. It can be tilled throughout a wide range of moisture content without crusting or clodding. The content of organic matter is low, and natural fertility is moderate. Cultivated crops can be grown intensively, for erosion generally is not a hazard. In some flat areas, excess water is a slight hazard during wet periods. Crops respond well to applications of lime and fertilizer.

This soil is used mainly for corn, soybeans, hay, and pasture. Capability unit I–3; woodland suitability group 2o1.

Uniontown silt loam, 2 to 6 percent slopes (UnB).—This gently sloping soil is on stream terraces along tributaries of the Ohio River. It is on low, broad ridges at an elevation a few feet higher than adjacent soils. Most areas are 4 to 20 acres in size. Slopes are convex.

Included with this soil in mapping were a few areas of Henshaw, Grenada, and Belknap soils. Also included were a few areas of a severely eroded Uniontown soil that is lighter colored and has a more clayey surface layer than the soil for which a profile is described as representative for the Uniontown series.

This Uniontown soil has a very friable surface layer and is easy to till. Except where erosion has exposed the finer textured subsoil, it can be tilled throughout a wide range of moisture content without crusting or clodding. The content of organic matter is low, and natural fertility is moderate. If management is good, most crops commonly grown in the survey area grow well, but erosion is a moderate hazard. If cultivated crops are grown, some erosion is likely to result if practices are not used to effectively control erosion. Crops grown on this soil respond well to applications of lime and fertilizer.

This soil is used mainly for row crops (fig. 14), hay, and pasture. Capability unit IIe–1; woodland suitability group 2o1.

Uniontown silty clay loam, 6 to 12 percent slopes, severely eroded (UoC3).—This sloping soil is on stream terraces along tributaries of the Ohio River. On the upper side, it is bounded by nearly level soils of stream terraces. On the lower side, it is bounded by nearly level soils of flood plains. In places the areas are dissected by drainageways. Slopes are generally only 100 to 300 feet long. All of the original surface layer has been lost through erosion. In places part of the subsoil has been lost and there are a few shallow rills and gullies. The present surface layer is lighter colored and contains more clay than the original one.

Included with this soil in mapping were a few areas of Markland and Henshaw soils, areas of a Uniontown soil that is not eroded, and areas of Belknap or Wakeland soils in places dissected by drainageways.

Clodding and crusting occur unless this Uniontown soil is worked when the content of moisture is nearly optimum. Natural fertility is moderately low, and the content of organic matter is very low. This soil is not suited to intensive cultivation, but it is well suited to

Figure 14.—Area of Uniontown silt loam, 2 to 6 percent slopes, used for corn and a cover crop.

permanent vegetation. If cultivated crops are grown, intensive practices that help to control further erosion are needed. Crops grown on this soil respond to applications of fertilizer. Where the alkaline substratum is exposed, lime is not needed for most of the commonly grown crops.

This soil is used mainly for row crops, hay, and pasture. A few areas are idle. Capability unit IVe-3; Woodland suitability group 3o1.

Urban Land

Urban land (Ur) consists of built-up areas. Where it occurs, the original soils are so altered that they cannot readily be identified, or the boundaries are obscured to the extent that they can no longer be plotted accurately. These original soils formed in alluvium deposited by the Ohio River. They are underlain by stratified gravel, sand, silt, and clay. Estimated depth to bedrock is 100 to 200 feet.

Areas of this mapping unit are in Owensboro. Some areas are in the main business district of that city. Others are in adjacent residential areas. In about 40 percent of the acreage, buildings, streets, sidewalks, and parking lots cover the soils. In another 40 percent, mostly in lawns and vacant lots, the soils cannot be readily identified because of grading and filling. Soils in the rest of the acreage are mainly in the Elk, Newark, and Wheeling series. Most areas are nearly level, but in some areas slopes are as much as 4 percent. Capability unit and woodland suitability group not assigned.

Wakeland Series

The Wakeland series consists of nearly level soils that are deep, silty, and somewhat poorly drained. These soils are on wide flood plains, mostly in the central and northern parts of Daviess County. They have formed in alluvium derived from loess.

In a representative profile, the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is mottled, very friable light silt loam about 26 inches thick. It is yellowish brown in the upper part and is grayish brown in the lower part. The substratum, also very friable light silt loam, is mottled grayish brown and yellowish brown.

Natural fertility is moderate, the content of organic matter is low, and available moisture capacity is high. Permeability is moderate. The root zone is deep, except where its depth is limited by a high water table.

Crops grown on these soils respond well to applications of fertilizer. Lime is generally not needed for the crops commonly grown in the survey area.

Representative profile of Wakeland silt loam (in Daviess County, 1 mile southwest of Owensboro, one-fourth mile north of Scherm Road, and 200 feet west of Carter Road):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; neutral; abrupt, smooth boundary.

B21—8 to 16 inches, yellowish-brown (10YR 5/4) light silt loam; many, medium distinct mottles of grayish brown (10 YR 5/2); weak, fine, granular structure; very friable; few roots; medium acid; gradual, smooth boundary.

B22g—16 to 34 inches, grayish-brown (2.5Y 5/2) light silt loam; common, medium, distinct mottles of brown (10YR 5/3); weak, fine, granular structure; very friable; neutral; diffuse, smooth boundary.

Cg—34 to 60 inches, mottled grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/6) light silt loam; massive; very friable; few dark grayish-brown (10 YR 4/2) krotovinas about 2 inches in diameter; neutral.

Color of the Ap horizon ranges from dark yellowish brown (10YR 4/4) to brown (10YR 5/3) or dark grayish brown (10YR 4/2). The dominant colors of the B21 horizon are brown (10YR 4/3) to yellowish brown (10YR 5/4). Mottles in the B21 horizon range from dark gray (10YR 4/1) to light brownish gray (10YR 6/2) or grayish brown (10YR 5/2). Dominant colors in the B22g and Cg horizons range from dark gray (10YR 4/1) to light brownish gray (2.5Y 6/2) or grayish brown (2.5Y 5/2). Mottles in those horizons range from dark brownish gray (10 YR 4/2) to yellowish brown (10YR 5/6) or brown (10YR 5/3). Reaction in the Cg horizon ranges from medium acid to mildly alkaline. Thickness of the solum ranges from 24 to 36 inches. Reaction throughout the solum is medium acid to neutral. The alluvium is more than 8 feet thick.

Wakeland soils are near Wilbur, Melvin, Belknap, and Calloway soils. They are more grayish in the upper part of the subsoil than Wilbur soils, have a less grayish subsoil than Melvin soils, and have a less acid subsoil than Belknap soils. Wakeland soils lack the fragipan that is characteristic of Calloway soils. They are similar to Newark soils in drainage, but they have a more silty subsoil than those soils.

Wakeland silt loam (0 to 2 percent slopes) (Wa).—This is the only Wakeland soil mapped in the survey area. It is on wide flood plains, mostly near soils of uplands that have formed in a thick layer of loess. Most areas are 20 to 100 acres in size.

Included with this soil in mapping were a few areas of a soil that is strongly acid in the upper part of the subsoil, and areas of a soil that has more clay in the subsoil than this Wakeland soil. Also included were a few areas of Wilbur, Melvin, and Belknap soils.

This Wakeland soil can be worked throughout a wide range of moisture content without crusting or clodding. It is not subject to erosion and can be cultivated intensively. Flooding is a hazard, but it generally occurs in winter and in spring, when damage to crops is slight. Improving drainage would lower the water table and would provide a deeper root zone for plants. It would thus make the soil more suitable for crops and for other uses and would permit earlier planting in spring.

This soil is used mainly for corn, soybeans, hay, and pasture. Capability unit IIw-1; woodland suitability group 1w1.

Waverly Series

In the Waverly series are nearly level soils that are deep, silty, and poorly drained. These soils are on flood plains, mostly in the southern and eastern parts of the survey area. They have formed in alluvium from loess.

In a representative profile in a wooded area, the surface layer is mottled brown, yellowish-brown, and light brownish-gray silt loam about 5 inches thick. It is covered with about 1 inch of forest litter. The subsoil, about 13 inches thick, is light brownish-gray, mottled, very friable silt loam. The subsoil is underlain by light-gray, mottled, friable silt loam that extends to a depth of 50 inches or more.

Roots can easily penetrate these soils, but growth of roots may be restricted by a seasonal high water table.

Available moisture capacity is high, and permeability and natural fertility are moderate. The content of organic matter is low.

Crops grown on these soils respond well to applications of lime and fertilizer.

Representative profile of Waverly silt loam (in Daviess County, 2 miles south of Masonville, one-half mile west of U.S. Highway No. 231, and 150 feet east of the Maxwell-Red Hill Road):

O1—1 inch to 0, partly decayed forest litter.

A—0 to 5 inches, mottled brown (10YR 5/3), yellowish-brown (10YR 5/4), and light brownish-gray (10YR 6/2) silt loam; moderate, fine, granular structure; very friable; many roots; very strongly acid; clear, smooth boundary.

B2g—5 to 18 inches, light brownish-gray (10YR 6/2) silt loam; common, medium, distinct mottles of yellowish red (5YR 4/6); weak, coarse, granular structure; very friable; many roots; strongly acid; clear, wavy boundary.

Cg—18 to 50 inches, light-gray (10YR 7/1) silt loam; few, medium, prominent mottles of dark reddish brown (2.5YR 4/3) and common, medium, distinct mottles of yellowish brown (10YR 5/6); massive; friable; strongly acid.

In cultivated areas the profile contains an Ap horizon that is dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). Dominant colors in the B and C horizons range from dark gray (10YR 4/1) to light gray (2.5YR 7/2). Mottles in those horizons range from brown (7.5YR 4/4) or pale brown (10YR 6/3) to yellowish brown (10YR 5/6 or yellowish red (5YR 4/6). The entire profile is silt loam that is less than 18 percent clay and normally contains no sand. Reaction throughout the profile is very strongly acid or strongly acid, except that the Ap horizon in areas where lime has been applied is less acid than in other areas. The sediment in which these soils formed is more than 6 feet thick.

The average annual temperature of Waverly soils in the survey areas is 1 to 2 degrees cooler than the defined range for the Waverly series. This difference does not alter the usefulness and behavior of the soils.

Waverly soils are near Collins, Belknap, Melvin, and Karnak soils. They are more grayish in the upper part of the profile than Collins and Belknap soils, are more acid and have a more silty subsoil than Melvin soils, and are more acid and have a less clayey subsoil than Karnak soils. Waverly soils are similar to Ginat soils in drainage, but they lack the fragipan and contain more silt than is characteristic of Ginat soils.

Waverly silt loam (0 to 2 percent slopes) (We).—This is the only Waverly soil mapped in the survey area. It is on flood plains in the drainage areas of most streams that flow from uplands in Daviess and Hancock Counties. In many places it is in slight depressions. Size of the areas in narrow valleys is generally 5 to 20 acres. Size of those in wide valleys is 50 to 200 acres.

Included with this soil in mapping were a few areas of Melvin and Belknap soils. Also inculded were a few areas of soils that have more sand or more clay in the subsoil than does this Waverly soil.

This Waverly soil is in good tilth and can be worked throughout a wide range of moisture content without crusting or clodding. If it is used for crops, however, drainage must be improved in most places to lower the seasonal high water table. Erosion is not a hazard, but this soil is subject to flooding in winter and in spring. Crops are not likely to be damaged by the floodwaters, and this soil can be cultivated intensively if drainage is improved. Even where drainage is improved, crops that require a well-drained soil do not grow well.

This soil is used mainly for corn, soybeans, hay, and pasture. Some areas that have not been drained are in trees or are idle. Capability unit IIIw-1; woodland suitability group 1w2.

Weinbach Series

The Weinbach series consists of somewhat poorly drained, deep, nearly level soils that have a fragipan. These soils are in the northern part of the survey area, where they occur on stream terraces in the valley of the Ohio River. They have formed in alluvium from several different sources.

In a representative profile, the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is about 32 inches thick. It is mottled yellowish-brown, grayish-brown, and light brownish-gray, friable heavy silt loam to a depth of about 24 inches. Below that depth, the subsoil is a firm and brittle fragipan of mottled light-gray and yellowish-brown silt loam. The substratum is mottled light-gray and yellowish-brown silty clay loam that extends to a depth of 50 inches or more.

Available moisture capacity is moderate, natural fertility is moderately low, and the content of organic matter is low. Permeability is moderate above the fragipan, but it is slow in the pan.

Representative profile of Weinbach silt loam (in Daviess County, 1 mile east of Stanley, one-half mile north of a railroad, and 50 feet west of a barn):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; a few roots; medium acid; abrupt, smooth boundary.

B1—8 to 11 inches, mottled yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) heavy silt loam; weak, fine, subangular blocky structure; friable; few, soft, brown concretions; very strongly acid; gradual, wavy boundary.

B2g—11 to 24 inches, mottled grayish-brown (10YR 5/2), light brownish-gray (10YR 6/2), and yellowish-brown (10YR 5/6) heavy silt loam; weak, fine, granular structure; friable; few, soft, brown concretions; very strongly acid; gradual, smooth boundary.

Bx1—24 to 29 inches, mottled light-gray (10YR 6/1) and yellowish-brown (10YR 5/8) silt loam; weak, fine, subangular blocky structure; firm, brittle and compact; cracks and ped surfaces coated with grayish-brown (10YR 5/2) clay; few, soft, brown concretions; very strongly acid; clear, smooth boundary.

Bx2—29 to 40 inches, coarsely mottled light-gray (10YR 6/1) and yellowish-brown (10YR 5/6) heavy silt loam; weak fine, subangular blocky structure; firm and brittle; contains many pores; few, soft, brown concretions; few patchy clay films; very strongly acid; gradual, smooth boundary.

C—40 to 50 inches, mottled light-gray (10YR 6/1) and yellowish-brown (10YR 5/6) silty clay loam; massive; firm; strongly acid.

Horizons above the fragipan have dominantly grayish colors, but they contain brownish mottles. Color of the Ap horizon ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/2). The B horizons are yellowish brown (10YR 5/6) to light gray (10YR 6/1) or dark gray (10YR 4/1). Reaction in the B horizons is strongly acid or very strongly acid. In places the fragipan is silty clay loam. The C horizon has dominantly brownish colors in many places, and it contains grayish mottles. Texture of the C horizon is silt loam to silty clay loam. The solum ranges from about 38 to 48 inches in thickness. The stratified gravel, sand, silt, and clay in which these soils formed is more than 50 feet thick.

Weinbach soils are near Sciotoville, Ginat, and Newark soils. They have a more grayish subsoil than Sciotoville soils and are less grayish in the upper part of the subsoil than Ginat soils. Weinbach soils have a fragipan that is lacking in Newark soils. They are similar to the Calloway soils in drainage, but they contain less silt than do those soils. Unlike the Calloway soils, which have formed in loess, Weinbach soils have formed in alluvium.

Weinbach silt loam (0 to 2 percent slopes) (Wh).—This is the only Weinbach soil mapped in the survey area. It is on wide, low stream terraces in the valley of the Ohio River. The areas are mostly long and narrow and lie roughly parallel to streams. They are at an elevation about halfway between areas occupied by higher lying, better drained soils on stream terraces and areas occupied by lower lying soils on flood plains. Size of individual areas is about 8 to 20 acres.

Included with this soil in mapping were a few areas of Newark, Sciotoville, and Ginat soils, and a few areas of a soil that has more sand throughout the profile than this Weinbach soil. Also included were areas of a soil that is better drained than this Weinbach soil and that has dominant brownish colors above the fragipan.

This Weinbach soil has a friable plow layer and is easy to till. It can be tilled throughout a wide range of moisture content without crusting or clodding. Erosion is not a hazard in most places. Cultivated crops can be grown intensively, but this soil is poorly suited to crops that require good drainage and a deep root zone. In wet periods water tends to collect on the surface of flat areas and above the slowly permeable fragipan. Most areas are above flood level, but some low areas are flooded occasionally in winter or in spring. Crops grown on this soil respond well to applications of lime and fertilizer.

This soil is used mainly for corn, soybeans, hay, and pasture. Capability unit IIIw-3; woodland suitability group 1w1.

Wellston Series

The Wellston series consists of deep, well-drained soils that are sloping to moderately steep. These soils are on uplands in the southern and eastern parts of the survey area. They have formed in loess and in the underlying material weathered from sandstone, siltstone, and shale.

In a representative profile, the surface layer is brown heavy silt loam about 5 inches thick. The subsoil is brown, friable light silty clay loam to a depth of about 26 inches. Below that depth, and extending to a depth of about 40 inches, it is yellowish-brown, mottled, firm heavy silt loam. The substratum is dark yellowish-brown mottled, firm fine sandy loam. It is underlain by soft sandstone at a depth of about 60 inches.

The root zone is deep. Available moisture capacity is high, and permeability is moderate.

Crops grown on these soils respond well to applications of fertilizer and lime.

Representative profile of Wellston silt loam, 12 to 30 percent slopes, severely eroded (in Hancock County, 1½ miles west of the Breckinridge County line and 500 feet north of State Route No. 144):

Ap—0 to 5 inches, brown (7.5YR 4/4) heavy silt loam; weak, fine, granular structure; friable; many roots; medium acid; clear, smooth boundary.

B2t—5 to 26 inches, brown (7.5YR 4/4) light silty clay loam, yellowish brown (10YR 5/6) if crushed; moderate, fine, subangular blocky structure; friable; few roots; continuous clay films; strongly acid; gradual, smooth boundary.

IIB3t—26 to 40 inches, yellowish-brown (10YR 5/4) heavy silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2) and brown (10YR 4/3); moderate, medium, angular blocky structure; firm; continuous clay films; soft concretionary material; about 15 percent of horizon is fine sand; very strongly acid; gradual, smooth boundary.

IIC—40 to 60 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; common, coarse, distinct mottles of light brownish gray (10YR 6/2); massive; firm; very strongly acid.

R—60 inches, soft sandstone.

The Ap horizon is dark brown (10YR 4/3) or brown (10YR 5/3) in areas that are not eroded and is brown (7.5YR 4/4) in several eroded areas. In areas that have not been cultivated, these soils have a dark-brown (10YR 3/3) A1 horizon and a brown (10YR 4/3) to yellowish-brown (10YR 5/4) A2 horizon. The B2t horizon is brown (7.5YR 4/4) to strong brown (7.5YR 5/6). Texture of the B2t horizon is typically light silty clay loam, but it ranges to heavy silt loam. Color of the IIB3t horizon ranges from yellowish-brown (10YR 5/4) or strong brown (7.5YR 5/6) to dark grayish brown (10YR 4/2) or light brownish gray (10YR 6/2). In places that horizon is loam, and in some areas from 5 to 15 percent of that horizon is coarse fragments. The IIC horizon ranges from silty clay loam to fine sandy loam or sandy clay loam in texture. In some places from 10 to 30 percent of that horizon is coarse fragments.

Wellston soils are near Frondorf, Zanesville, and Loring soils of uplands and near Shelocta soils of foot slopes. They have a thicker solum and are deeper to bedrock than Frondorf soils, and they lack the fragipan that is typical in the profile of Zanesville and Loring soils. Wellston soils lack the coarse fragments throughout the profile that are characteristic of Shelocta soils, and they are more reddish in the upper part of the subsoil than Shelocta soils.

Wellston silt loam, 6 to 12 percent slopes (WlC).—This sloping soil is on uplands, mostly in the central and southern parts of Hancock County. It is mainly on the sides of hills in areas that are 100 to 500 feet wide and that extend several hundred feet around the hill. Some areas are on ridgetops in areas 200 to 500 feet wide, and the slopes in those places are convex. Most areas are dissected by drainageways. The surface layer is less reddish and is more friable than the one in the profile described as representative for the Wellston series.

Included with this soil in mapping were areas of Loring, Frondorf, Zanesville, and Collins soils. Also included were a few areas of a soil that is deeper to bedrock than this Wellston soil, and areas of a soil in which the lower part of the profile is clay.

This Wellston soil has a very friable surface layer and is easy to till. It can be worked throughout a wide range of moisture content without crusting or clodding. The content of organic matter is low, and natural fertility is moderate. Roots, air, and moisture can easily penetrate the subsoil. Most of the crops commonly grown in the survey area can be grown, but erosion is a severe hazard. Practices that effectively reduce runoff and that help to reduce erosion are needed if cultivated crops are grown.

This soil is used mainly for tobacco (fig. 15), corn, small grain, hay, pasture, and trees. A few areas are idle. Capability unit IIIe-1; woodland suitability group 2o1.

Figure 15.—**Area of Wellston silt loam, 6 to 12 percent slopes, in tobacco.**

Wellston silt loam, 6 to 12 percent slopes, severely eroded (WlC3).—This sloping soil is mostly on the sides of hills in the central and southern parts of Hancock County. It has slopes that are mostly 100 to 500 feet long. Most areas are dissected by drainageways. All of the original surface layer has been removed by erosion. In places part of the subsoil has also been removed and there are a few shallow rills and gullies.

Included with this soil in mapping were some areas of Collins, Zanesville, Loring, and Frondorf soils, and a few areas of a soil that has a more sandy subsoil than this Wellston soil. Also included were areas of a soil in which the lower part of the profile is clay.

This Wellston soil is fairly easy to till, but it is less friable than Wellston silt loam, 6 to 12 percent slopes. The content of organic matter is very low, and natural fertility is moderately low. Roots, air, and moisture can easily penetrate the subsoil. Grasses and legumes commonly grown in the survey area for pasture and meadow grow well, and a fair to moderate amount of forage is generally obtained. Row crops can also be grown occasionally. Where row crops are grown, practices that reduce runoff and that help to control erosion are needed.

Most areas of this soil were formerly used for cultivated crops. Now, this soil is used mainly for corn, small grain, hay, and pasture. Part of the acreage is idle and is revegetating naturally. Capability unit IVe-3; woodland suitability group 3o1.

Wellston silt loam, 12 to 20 percent slopes (WlD).—This strongly sloping soil is mostly on the sides of hills in Hancock County and in the southern and eastern parts of Daviess County. Many of the areas are dissected by drainageways. Slopes are mostly between 200 and 500 feet long. The surface layer is less reddish and is more friable than the one in the profile described as representative for the Wellston series.

Included with this soil in mapping were a few areas of Zanesville, Loring, Frondorf, and Collins soils, and a few areas of a soil that has more sand in the lower part of the subsoil than this Wellston soil. Also included were areas of a soil in which the lower part of the subsoil is clay.

This Wellston soil has a very friable plow layer and can be worked throughout a wide range of moisture content without crusting or clodding. It has moderate natural fertility and is low in content of organic matter. Roots, air, and moisture can readily penetrate the subsoil. This soil is suited to grasses, legumes, and trees. Most other crops that are commonly grown in the survey area can be grown, but the hazard of erosion is very

severe if row crops are grown. A row crop can be grown occasionally if practices that reduce runoff and that help to control erosion are used.

This soil is mostly in hay, pasture, or trees. Capability unit IVe–1; woodland suitability group 2o1.

Wellston silt loam, 20 to 30 percent slopes (WlE).—This moderately steep soil is on the sides of hills in Hancock County and in the southern and eastern parts of Daviess County. Many of the areas are dissected by drainageways. Slopes range from 300 to 600 feet in length and from 10 to 20 acres in size. The surface layer is less reddish and is more friable than the one in the profile described as representative for the Wellston series.

Included with this soil in mapping were areas of Loring, Zanesville, Frondorf, and Collins soils, and a few areas of a soil that has more sand in the subsoil than this Wellston soil. Also included were areas of a soil in which the lower part of the subsoil is clay.

This Wellston soil has moderate natural fertility but is low in content of organic matter. It is subject to very severe erosion. Therefore, it is not suited to cultivated crops, but permanent vegetation can be grown. Most of the grasses and legumes commonly grown in the survey area grow well if management is good.

This soil is mainly in hay, pasture, or trees, but a few areas are idle and are revegetating naturally. Some areas have never been cultivated. Capability unit VIe–1; woodland suitability group 2o1.

Wellston silt loam, 12 to 30 percent slopes, severely eroded (WlE3).—This strongly sloping to moderately steep soil is on the sides of hills in Hancock County and in the southern and eastern parts of Daviess County. Slopes are 200 to 500 feet long. Individual areas range from 10 to 30 acres in size. The profile is the one described as representative for the Wellston series. All of the original surface layer has been removed by erosion. In places part of the subsoil has also been removed and there are a few shallow rills and gullies.

Included with this soil in mapping were some areas of Loring, Zanesville, Frondorf, and Collins soils, and a few areas of a soil that has more sand in the subsoil than this Wellston soil. Also included were areas of a soil in which the lower part of the subsoil is clay.

The plow layer of this Wellston soil is slightly sticky when wet. Roots, air, and moisture easily penetrate the subsoil. The content of organic matter is very low, and natural fertility is moderately low. Permanent vegetation can be grown, but this soil is not suited to row crops. It can be used for most of the commonly grown grasses and legumes.

This soil is used mainly for hay, pasture, and trees. Most areas were formerly cultivated, and a few areas are still used for row crops. Some areas that are idle and that are revegetating naturally provide food and cover for wildlife. Capability unit VIe–3; woodland suitability group 3o1.

Wheeling Series

The Wheeling series consists of deep, well-drained soils that are nearly level to sloping. These soils are on stream terraces in the northern part of the survey area. They have formed in alluvium deposited by the Ohio River.

In a representative profile, the surface layer is brown loam about 7 inches thick. The subsoil is brown, friable light clay loam in the upper part and is brown, friable heavy loam in the lower part. It is underlain at a depth of about 25 inches by yellowish-brown, mottled, friable fine sandy loam that extends to a depth of 50 inches or more.

Available moisture capacity is high, natural fertility is moderate, and the content of organic matter is low. Natural fertility and permeability are moderate. The root zone is deep.

Crops grown on these soils respond well to applications of lime and fertilizer.

Representative profile of Wheeling loam, 0 to 2 percent slopes (In Daviess County, 2 miles east of Stanley, one-half mile south of River Road, and 50 feet west of Wimsatt Road):

Ap—0 to 7 inches, brown (10YR 4/3) loam; weak, fine, granular structure; very friable; few roots; strongly acid; clear, smooth boundary.

B21t—7 to 12 inches, brown (7.5YR 4/4) light clay loam; weak, fine, subangular blocky structure; friable; patchy clay films; few roots; strongly acid; gradual, smooth boundary.

B22t—12 to 25 inches, brown (7.5YR 4/4) heavy loam; moderate, medium, subangular blocky structure; friable; continuous clay films; strongly acid; gradual, smooth boundary.

C—25 to 50 inches, yellowish-brown (10YR 5/4) fine sandy loam; common, medium, faint mottles of dark yellowish brown (10YR 4/4); massive; friable; strongly acid.

Color of the Ap horizon ranges from brown (10YR 4/3) to dark grayish brown (10YR 4/2). In some places these soils have a B1 horizon of dark yellowish-brown (10YR 4/4) loam. The B2t horizons are brown (7.5YR 4/4) to strong brown (7.5YR 5/6). They are firm or friable and have a texture of loam to clay loam. The C horizon is brown (7.5YR 4/4) to yellowish brown (10YR 5/4 or 5/6), and in places it is loam. Reaction throughout the profile is strongly acid or medium acid. The solum ranges from about 24 to 40 inches in thickness. The underlying material is gravel, sand, silt, and clay. Bedrock is at a depth of more than 50 feet.

Wheeling soils in this survey area have a thinner solum than the defined range for the series. This difference does not alter the usefulness and behavior of these soils.

Wheeling soils are near Lakin, Elk, Otwell, Sciotoville, Weinbach, and Ginat soils. Their entire profile is less sandy than that of the Lakin soils, and they have more sand in the A and B horizons than Elk soils. Wheeling soils lack the fragipan that is characteristic in the profile of Otwell, Sciotoville, Weinbach, and Ginat soils. They also lack grayish colors in the subsoil that are characteristic of Weinbach and Ginat soils.

Wheeling loam, 0 to 2 percent slopes (WnA).—This nearly level soil is on long, low ridges at a slightly higher elevation than adjacent soils. It is in a part of the survey area where most of the soils are nearly level. The areas are roughly parallel to streams, and they range from 5 to 20 acres in size. The profile is the one described as representative for the Wheeling series.

Included with this soil in mapping were a few areas of Elk and Sciotoville soils, and a few areas of a Wheeling soil that has a surface layer of fine sandy loam. Also included were areas of soils that are very strongly acid or are only slightly acid throughout the profile. Other inclusions consist of a soil that has more sand throughout the profile than this Wheeling soil, and areas of a soil that has a dark-brown surface layer.

On some farms this Wheeling soil is the highest lying and the best drained of any of the soils on the farm. It has a very friable plow layer, is easy to till, and can be tilled throughout a wide range of moisture content without crusting or clodding. Roots, air, and moisture easily penetrate. All of the crops commonly grown in the survey area are suitable, and cultivated crops can be grown intensively without risk of erosion. A few low areas are subject to occasional flooding.

This soil is used mainly for tobacco, corn, soybeans, small grain, hay, and pasture. On many farms it is used as the sites for the farm buildings. Capability units I-3; woodland suitability group 2o1.

Wheeling loam, 2 to 6 percent slopes (WnB).—This gently sloping soil is on long, low ridges on stream terraces in the valley of the Ohio River. It is at a slightly higher elevation than adjacent soils. The areas are in a part of the survey area where most of the soils are nearly level. Slopes are convex.

Included with this soil in mapping were a few areas of Elk and Sciotoville soils, and a few areas of a Wheeling soil that has a surface layer of fine sandy loam. Also included were areas of a soil that has more sand throughout the profile than Wheeling soils; areas of a soil that is slightly acid throughout the profile; and areas of a soil that is more acid throughout the profile than Wheeling soils. Other inclusions consist of areas of a soil that has a dark-brown surface layer.

This Wheeling soil can be tilled throughout a wide range of moisture content without crusting or clodding. It is easily penetrated by roots, air, and moisture. Most of the crops commonly grown in the survey area can be grown. Cultivated crops can be grown intensively, but erosion is a moderate hazard. Effective erosion-control practices are needed in cultivated areas. Flooding is a hazard in a few low areas.

This soil is used mainly for corn, tobacco, soybeans, small grain, hay, and pasture. On some farms it is used as a site for the farm buildings. Capability unit IIe-1; woodland suitability group 2o1.

Wheeling loam, 6 to 12 percent slopes (WnC).—This sloping soil is on the sides of long ridges in the valley of the Ohio River. It occurs in areas 5 to 15 acres in size. Slopes are 200 to 500 feet long.

Included with this soil in mapping were areas of Elk and Sciotoville soils; areas of a severely eroded Wheeling soil that has a more reddish, more clayey surface layer than this uneroded Wheeling soil; and a few areas of a soil that has more sand throughout the profile than this Wheeling soil.

In most places this soil can be satisfactorily tilled throughout a wide range of moisture content without risk of clodding or crusting. In the severely eroded areas that are included, however, crusts and clods tend to form if this soil is cultivated when wet. The hazard of erosion is severe. If cultivated crops are grown, effective erosion-control practices are needed. A few low areas are occasionally flooded by waters of the Ohio River.

This soil is used mainly for row crops, small grain, hay, and pasture. Capability unit IIIe-1; woodland suitability group 2o1.

Wilbur Series

The Wilbur series consists of silty soils that are deep, moderately well drained, and nearly level. These soils are on flood plains, mostly in the northern part of Daviess County. They have formed in alluvium derived from loess.

In a representative profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 26 inches thick. It is mottled, very friable light silt loam that is yellowish brown in the upper part and is light brownish gray and brown in the lower part. The substratum is mottled grayish-brown and brown, very friable light silt loam in the upper part and is gray, mottled, very friable silt loam in the lower part. It extends to a depth of 50 inches or more.

Natural fertility is moderate, and the content of organic matter is low. Permeability is also moderate, and the available moisture capacity is high.

These soils are easy to till and can be tilled throughout a wide range of moisture content without crusting or clodding. Crops grown on them respond well to applications of fertilizer. Lime is not needed in most places.

Representative profile of Wilbur silt loam (in Daviess County, 2 miles south of Yelvington, one-fourth mile east of State Route No. 405, and 100 feet east of a barn):

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; few roots; slightly acid; clear, smooth boundary.

B1—9 to 23 inches, yellowish-brown (10YR 5/4) light silt loam; common, medium, faint mottles of pale brown (10YR 6/3); weak, fine, granular structure; very friable; few roots; slightly acid; abrupt, smooth boundary.

B2—23 to 35 inches, mottled light brownish-gray (10YR 6/2) and brown (10YR 4/3 and 7.YR 4/4) light silt loam; weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

C1g—35 to 38 inches, mottled grayish-brown (10YR 5/2) and brown (10YR 4/3) light silt loam; massive; very friable; neutral; clear, smooth boundary.

C2g—38 to 50 inches, gray (10YR 6/1) silt loam; common, medium, distinct mottles of brown (7.5YR 4/4); massive; very friable; neutral.

Color of the Ap horizon ranges from brown (10YR 5/3) to dark yellowish brown (10YR 4/4). Dominant colors in the B horizon range from brown (10YR 4/3) to light yellowish brown (10YR 6/4). In that horizon color of the mottles ranges from dark gray (10YR 4/1) to light gray (10YR 7/2) or pale brown (10YR 6/3). Some mottles that have chroma of 2 or less are above a depth of 24 inches. The C horizons are brown (7.5YR 4/4) to gray (10YR 6/1) or light gray (10YR 7/1). Mottles in those horizons range from grayish to brownish in color. Reaction throughout the profile ranges from medium acid to neutral. The solum ranges from 24 to 40 inches in thickness. Thickness of the alluvium is more than 10 feet.

Wilbur soils are near Wakeland and Melvin soils, but they are less grayish in the upper part of the subsoil than those soils. Wilbur soils are similar to Collins and Lindside soils, but they are less acid than Collins soils and they contain more silt than Lindside soils.

Wilbur silt loam (0 to 1 percent slopes) (Wu).—This soil is on flood plains, along the lower reaches of streams in wide valleys. It is the only Wilbur soil mapped in the survey area. Size of most areas is between 10 and 50 acres.

Included with this soil in mapping were a few areas of Collins, Belknap, and Wakeland soils, and a few areas of a soil that has a finer textured subsoil than characteristic of Wilbur soils. Also included were a few areas of a

soil that is stratified, and areas of a soil that is strongly acid in the upper part of the subsoil.

This Wilbur soil is slightly wet, but it is suited to most of the crops commonly grown in the survey area. Most areas are subject to occasional flooding in winter. Flooding is of short duration, however, and damage to the commonly grown crops is slight. Where drainage is improved, planting can be done earlier in spring. Erosion is not a hazard.

This soil is used mainly for row crops, hay, and pasture. Capability unit I-2; woodland suitability group 1w1.

Zanesville Series

In the Zanesville series are deep, moderately well drained and well drained, gently sloping or sloping soils that have a fragipan. These soils are on uplands in the eastern part of the survey area. They have formed in a thin layer of loess and in material weathered from sandstone, siltstone, and shale.

In a representative profile, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of about 40 inches. The upper part of the subsoil is brown or strong-brown, friable heavy silt loam. The lower part, at a depth of about 26 inches, is a firm, brittle and compact fragipan of brown, mottled silt loam. The substratum, also a part of the fragipan, is yellowish-brown, mottled silt loam. It is underlain by soft sandstone bedrock at a depth of about 60 inches.

Available moisture capacity is moderate. Permeability is moderate above the fragipan and is slow in the fragipan.

Representative profile of Zanesville silt loam, 2 to 6 percent slopes (in Hancock County on top of a hill, one-half mile north of Easton, and 50 feet west of the Easton-Hawesville Road):

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B21t—8 to 20 inches, brown (7.5YR 4/4) heavy silt loam; weak and moderate, fine, subangular blocky structure; friable; few roots; thin, continuous clay films; very strongly acid; gradual, smooth boundary.

B22t—20 to 26 inches, strong-brown (7.5YR 5/6) heavy silt loam; common, medium, subangular blocky structure; friable; thin, continuous clay films; very strongly acid; clear, wavy boundary.

Bx—26 to 40 inches, brown (7.5YR 4/4) silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2); weak, very coarse, prismatic structure that parts to moderate, medium, angular blocky structure; hard, firm, compact and brittle; clay films on ped surfaces; veins of light brownish-gray (2.5Y 6/2) silty clay loam separate the prisms; veins contain a few roots; very strongly acid; gradual, smooth boundary.

IICx—40 to 60 inches, yellowish-brown (10YR 5/4) silt loam (about 15 percent sand); common, medium, distinct mottles of light brownish gray (10YR 6/2); massive; firm, brittle and compact; tongues of gray (10YR 6/1) material extend downward from the Bx horizon; very strongly acid.

R—60 inches, soft sandstone bedrock.

Color of the Ap horizon is dominantly brown (10YR 4/3), but it ranges to brown (10YR 5/3) or dark yellowish brown (10YR 4/4). The B21t horizon is brown (7.5YR 4/4) to strong brown (7.5YR 5/6), and the B22t horizon is brown (7.5YR 4/4) to yellowish brown (10YR 5/6). In places the B21t and B22t horizons are light silty clay loam. Depth to the fragipan (Bx horizon) ranges from 22 to 32 inches. The Bx and IICx horizons contain grayish and brownish mottles in hues of 10YR and 7.5YR. The IICx horizon ranges from silt loam or fine sandy loam to loam, silty clay loam, or sandy clay loam. In some places from 5 to 30 percent of the IICx horizon is fragments of sandstone. Reaction throughout the profile is strongly acid or very strongly acid. The solum ranges from 34 to 55 inches in thickness. Depth to bedrock is 4 to 6 feet.

Zanesville soils are near Wellston, Frondorf, Loring, and Grenada soils of uplands and near Shelocta soils of foot slopes. They have a fragipan that is lacking in Wellston and Frondorf soils, and they have formed in a thinner layer of loess and are shallower over bedrock than Loring soils. Their subsoil is more reddish above the fragipan than that of Grenada soils. Zanesville soils lack the high content of gravel that is typical in the profile of Shelocta soils, and they have a fragipan that is lacking in Shelocta soils.

Zanesville silt loam, 2 to 6 percent slopes (ZaB).—This gently sloping soil is mostly on narrow, winding ridgetops, mainly in the southeastern part of the survey area. Its slopes are convex in most places. Size of individual areas is about 5 to 20 acres. The profile is the one described as representative for the Zanesville series.

Included with this soil in mapping were areas of Wellston, Loring, and Grenada soils and some areas of an eroded Zanesville soil that has a more reddish surface layer than this soil. Also included were areas of a soil that is extremely acid in the lower part of the subsoil.

This Zanesville soil is generally easy to till and can be tilled throughout a wide range in moisture content without crusting or clodding. If the most severely eroded areas that are included are worked when too wet, however, they tend to clod and crust. The content of organic matter is low, and natural fertility is moderate. Most crops commonly grown in the survey area can be grown, but erosion is a moderate hazard. If cultivated crops are grown, effective erosion-control practices are needed.

This soil is used mainly for row crops, hay, and pasture. Because it is on ridgetops, however, it is also used as sites for roads and homesteads. Small areas that are adjacent to areas of steep soils are idle or in trees. Capability unit IIe-3; woodland suitability group 3o1.

Zanesville silt loam, 6 to 12 percent slopes (ZaC).—This sloping soil is mostly in the eastern part of the survey area. It is on narrow, winding ridgetops in areas mostly occupied by hilly soils, and on side slopes in areas that are mostly occupied by undulating soils. Most of the areas on side slopes are dissected by drainageways. Individual areas are 5 to 30 acres in size.

Included with this soil in mapping were a few areas of Wellston, Loring, and Grenada soils. Also included in the areas dissected by drainageways, were small areas of Collins and Belknap soils. Other inclusions consist of areas of an eroded Zanesville soil that has a more reddish surface layer than this soil, and areas of a soil that is extremely acid in the lower part of the subsoil.

This Zanesville soil is easy to till and can be tilled throughout a wide range of moisture content without clodding or crusting. It is low in content of organic matter and has moderate natural fertility. Most crops commonly grown in the survey area can be grown, but erosion is a severe hazard. If cultivated crops are grown, practices that control runoff and that help to control erosion are needed. Crops respond well to applications of lime and fertilizer.

This soil is used mainly for row crops, hay, pasture, and trees. Some areas on ridgetops are also used as sites for roads and homesteads. Other areas, mostly in places where most of the soils are hilly, are idle. Capability unit IIIe-2; woodland suitability group 3o1.

Zanesville silt loam, 6 to 12 percent slopes, severely eroded (ZaC3).—This sloping soil is on hillsides in the southern and eastern parts of the survey area. Some of the areas are dissected by drainageways. Size of individual areas is about 5 to 30 acres. All of the original surface layer has been lost through erosion. In places part of the subsoil has also been lost and there are shallow gullies and rills. The present surface layer is more reddish and contains more clay than the one in the profile described as representative for the Zanesville series, and the root zone is also shallower.

Included with this soil in mapping were a few areas of Loring, Grenada, and Wellston soils, and small areas of Collins and Belknap soils in the areas dissected by drainageways. Also included were areas of a soil that is similar to this Zanesville soil but that is extremely acid in the lower part of the subsoil.

If this Zanesville soil is tilled when wet, it is slightly sticky. It is very low in content of organic matter and is moderately low in natural fertility. In addition, erosion is a severe hazard if cultivated crops are grown. A cultivated crop can be grown infrequently, however, and this soil is suited to pasture and hay. Crops respond well to applications of lime and fertilizer. Practices that reduce runoff and that help to control erosion are needed.

This soil is used mainly for row crops, hay, and pasture. Some areas are idle and are revegetating naturally. They provide food and cover for wildlife. Capability unit IVe-4; woodland suitability group 4o1.

Use and Management of the Soils

This section is designed to help the landowner understand how soils behave and how they can be used. In it are discussed the use and management of soils for crops and pasture, as woodland, for wildlife habitat, for engineering purposes, and for town and country planning. The information given can be used as a general guide for managing the soils, but it does not supply specific suggestions for managing individual soils. Facts about individual soils can be found in the section "Descriptions of the Soils."

Use of Soils for Crops and Pasture [2]

In the following pages, use and management of soils used for crops and pastures are discussed. First, some general principles of managing soils are given. Then, the system of capability classification used by the Soil Conservation Service is explained and the capability units are described. Finally, a table shows estimated yields of the commonly grown crops for each of the soils in the survey area under two levels of management.

[2] Prepared in collaboration with WALTER J. GUERNSEY, conservation agronomist, Soil Conservation Service.

General principles of soil management

Some principles of soil management are general enough to apply to all soils suitable for farm crops and pasture. Individual soils or groups of soils, however, require different kinds of management. General principles of management suitable for all the soils in the survey area are discussed in the following paragraphs. Management needed for individual soils or for groups of soil can be found in discussions of the capability units.

Lime or fertilizer is needed for crops grown on many soils in the survey area. For crops grown on some soils, both lime and fertilizer are needed. The amounts required depend on the natural content of lime and plant nutrients, which can be determined by laboratory analyses of soil samples, by the needs of the crop to be grown, and by the level of yield desired. Only general suggestions for applying lime and fertilizer are given in this publication.

Most of the soils of the survey area never had a high content of organic matter, and to build up the content to a high level would not be economically feasible. It is important to return available organic matter to the soils by adding farm manure; by leaving plant residue on the surface; and by growing sod crops, cover crops, and green-manure crops.

Tillage tends to break down soil structure. Therefore, it should be kept to the minimum necessary for preparing a seedbed and controlling weeds. Maintaining the organic-matter content of the plow layer also helps to protect the soil structure.

Wet soils, as for example Melvin silt loam, can be made more suitable for cultivated crops by providing open-ditch drainage or tile drainage. The drains are expensive to install, but they generally provide better drainage than open ditches. Soils that have a fragipan are difficult to drain. Open ditches normally provide better drainage for those soils than tile drainage. The ditches should be deep enough to intercept water that moves horizontally on top of the fragipan. Suitable outlets are needed for either tile drains or open ditches.

All the gently sloping and steeper soils that are cultivated are subject to erosion. Runoff and erosion occur mostly while a cultivated crop is growing or soon after the crop has been harvested. On such erodible soils as Loring silt loam, 2 to 6 percent slopes, a cropping system that helps to control runoff and erosion is needed, and other erosion-control practices should be used. In this soil survey, the term "cropping system" refers to the sequence of crops grown, in combination with management practices that include minimum tillage, mulch planting, effectively using crop residue, growing cover crops and green-manure crops, and applying lime and fertilizer. Other practices that help to control erosion are cultivating on the contour, terracing, contour stripcropping, diverting runoff, and establishing grassed waterways. The effectiveness of any particular combinations of these practices differs from one soil to another, but different combinations can be equally effective on the same soil. A local representative of the Soil Conservation Service will assist land users in planning an effective combination of practices.

On all but a few of the soils subject to erosion, pasture is effective in controlling erosion. A high level of pasture

management is needed on some soils to provide a dense enough cover of plants to protect the soils from erosion. Such management provides for fertilization, control of grazing, selection of suitable pasture mixtures for seeding, and other practices that help to provide a good cover of plants and to supply adequate forage for grazing. Grazing is controlled by moving livestock from one pasture field to another and thus rotating grazing. To allow for regrowth of the plants, a rest period is provided for the pasture after each grazing period. It is important that a pasture mixture be selected that maintains a good cover of plants, that provides adequate forage for grazing, and that requires the least amount of renovation.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, the kinds of soil are grouped at three levels, the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals, indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion, but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat. (None in Daviess and Hancock Counties.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes. (None in Daviess and Hancock Counties.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil has limitations within the root zone because it is droughty, clayey, gravelly, or stony; and *c*, used in only some parts of the United States, but not in Daviess and Hancock Counties, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass. In Daviess and Hancock Counties, the capability units are numbered consecutively within each subclass.

Management by capability units

In the following pages, the capability units are described and suitable crops and management for the soils are suggested. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all soils in a given series are in the unit. To find the names of all the soils in a given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I-1

The only soil in this unit is Huntington silt loam. This soil is deep, nearly level, and well drained. It is on flood plains.

This soil has a surface layer and a subsoil of silt loam. Permeability is moderate, and available moisture capacity is high. The content of organic matter is medium, and natural fertility is very high. The surface layer is slightly acid to mildly alkaline.

This soil is suited to most crops grown in the survey area, and it is used mainly for corn, tobacco, soybeans.

small grain, pasture, and hay. Among the grasses and legumes to which this soil is suited are Kentucky 31 tall fescue, orchardgrass, alfalfa, red clover, annual lespedeza, and Ladino clover.

Erosion is not a hazard. Therefore, row crops can be grown year after year. Some areas are subject to flooding in winter and in spring.

CAPABILITY UNIT I-2

This unit consists of nearly level, moderately well drained soils on flood plains. These soils are in the Collins, Lindside, and Wilbur series.

These soils have a surface layer and a subsoil of very friable silt loam. They have a deep root zone. Permeability is moderate, and available moisture capacity is high. The content of organic matter is low to medium, and natural fertility is moderate to high. The surface layer of the Collins soil is strongly acid or very strongly acid. The surface layer of the Wilbur and Lindside soils is mostly medium acid or slightly acid.

Soils of this unit are easy to till and are suited to most crops grown in the survey area. Among the grasses and legumes to which they are suited are Kentucky 31 tall fescue, orchardgrass, timothy, annual lespedeza, alsike clover, red clover, and Ladino clover. The soils are used mainly for corn, soybeans, tobacco, small grain, hay, and pasture.

Because erosion is not a hazard, cultivated crops can be grown intensively. Drainage increases the suitability of these soils for some crops. Some areas are subject to flooding in winter and in spring.

CAPABILITY UNIT I-3

In this unit are nearly level soils of uplands and stream terraces. These soils are in the Ashton, Elk, Loring, Memphis, Uniontown, and Wheeling series. All except the Loring and Uniontown soils are well drained, but the Loring and Uniontown soils are moderately well drained or well drained.

The surface layer is very friable silt loam or loam, and it contains slightly less clay than the subsoil. All of the soils, except the Loring, have a deep root zone and are moderately permeable. The Loring soil has a root zone that is only moderately deep over fragipan, and that soil is moderately permeable in the upper part of the subsoil and is slowly permeable in the fragipan. For all the soils, available moisture capacity and natural fertility are moderate to high.

Soils of this unit are suited to corn, soybeans, tobacco, small grain, hay, pasture, and most other crops grown in the survey area. Among the grasses and legumes to which they are suited are orchardgrass, Kentucky 31 tall fescue, Kentucky bluegrass, timothy, alfalfa, red clover, alsike clover, Ladino clover, and annual lespedeza.

These soils can be cultivated intensively, for they are not subject to erosion. Most of the areas are above flood level, but a few low areas are subject to infrequent flooding in winter and in spring.

CAPABILITY UNIT IIe-1

This unit consists of deep, gently sloping soils on stream terraces and uplands. These soils are in the Elk, Memphis, Uniontown, and Wheeling series. All except the Uniontown soil are well drained, but the Uniontown soil is well drained or moderately well drained.

The surface layer of all of these soils, except the Wheeling, is very friable silt loam, but the surface layer of the Wheeling soil is loam. Available moisture capacity is high, and permeability is moderate. Natural fertility is moderate to high, and the content of organic matter is medium to low.

These soils are easy to till and are suited to all the locally grown crops. Among the grasses and legumes to which they are suited are Kentucky 31 tall fescue, orchardgrass, alfalfa, red clover, and annual lespedeza. The soils are used mainly for corn, soybeans, tobacco (fig. 16), small grain, hay, and pasture. Some areas on ridgetops or stream terraces higher than the adjacent soils are used as sites for buildings.

The hazard of erosion is moderate. If cultivated crops are grown, practices are needed that help to control erosion.

CAPABILITY UNIT IIe-2

This unit consists of moderately well drained, gently sloping soils on stream terraces and uplands. These soils are in the Grenada and Otwell series.

These soils have a surface layer of very friable silt loam. Their root zone is moderately deep to a fragipan. Air, water, and roots easily penetrate the surface layer and the upper part of the subsoil, but the fragipan restricts further penetration. Available moisture capacity is moderate. The content of organic matter is low, and natural fertility is moderate to moderately low.

Soils of this unit are easy to till and are suited to most of the locally grown crops. Among the hay and pasture plants to which they are suited are Kentucky 31 tall fescue, orchardgrass, Ladino clover, red clover, and annual lespedeza. The soils are used mainly for corn,

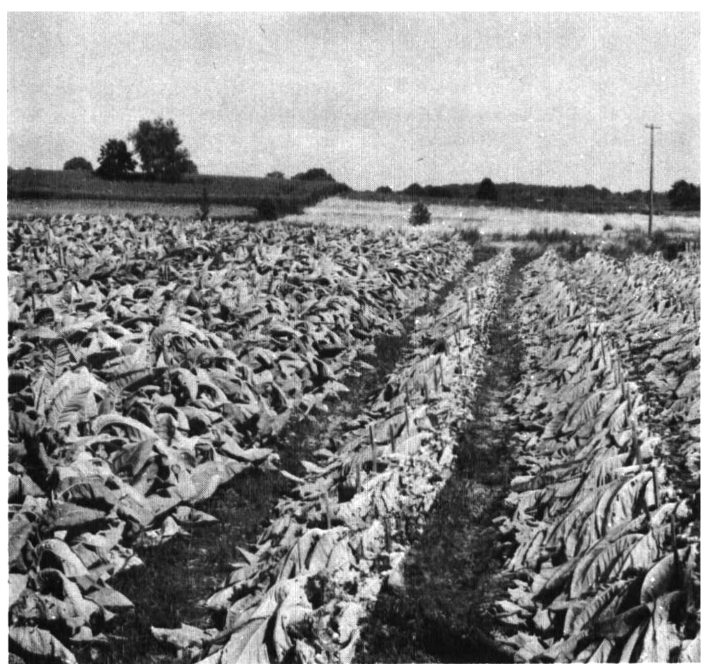


***Figure 16.*—Harvesting burley tobacco on a gently sloping soil of capability unit IIe-1.**

tobacco, soybeans, small grain, hay, and pasture. In places where they are in areas higher than those occupied by adjacent soils, they can be used as sites for buildings.

Erosion is a moderate hazard. Practices that help to control erosion are needed if these soils are cultivated.

CAPABILITY UNIT IIe-3

In this unit are well drained or moderately well drained, gently sloping soils on uplands. These soils are in the Loring and Zanesville series.

The surface layer is silt loam. Roots, air, and water readily penetrate the surface layer and the upper part of the subsoil, but further penetration is restricted by the fragipan in the lower part of the subsoil. Available moisture capacity and natural fertility are moderate. The content of organic matter is low.

These soils are easy to till and are suited to most crops grown in the survey area. Among the sod crops to which they are suited are Kentucky 31 tall fescue, orchardgrass, annual lespedeza, Ladino clover, red clover, and alsike clover. The soils are used mainly for corn, tobacco, small grain, hay, and pasture. Some areas on ridgetops are used as sites for buildings.

The hazard of erosion is moderate. If cultivated crops are grown, practices that help to control erosion are needed.

CAPABILITY UNIT IIw-1

This unit consists of deep, nearly level soils on flood plains. These soils are in the Belknap, Newark, Patton, and Wakeland series. The Patton soils are poorly drained, and the other soils are somewhat poorly drained.

The surface layer is silt loam. Roots and moisture easily penetrate to the seasonal high water table that is within 1½ feet of the surface in winter and in spring. Available moisture capacity is high, and natural fertility is moderate to very high. The surface layer of the Belknap soil is strongly acid or very strongly acid. The surface layer of the other soils is mostly slightly acid or neutral in reaction.

All the soils of this unit are easy to till. They are suited to annual crops that mature in summer and to plants that tolerate wetness. Among the crops to which these soils are suited are corn and soybeans, which grow well if drainage is provided and if management is good. Except where floodwaters from major streams remain for long periods, thus damaging the stand, these soils are suited to use for permanent pasture and hay. Among the grasses and legumes to which they are suited are Kentucky 31 tall fescue, Ladino clover, red clover, alsike clover, annual lespedeza, and timothy.

Most areas of these soils are subject to flooding, but erosion is not a hazard. Row crops can be grown year after year (fig. 17).

CAPABILITY UNIT IIw-2

This unit consists of moderately well drained, nearly level soils on stream terraces and uplands. These soils are in the Grenada, Otwell, and Sciotoville series.

These soils have a surface layer of silt loam or loam. They are very friable and have a moderately deep root zone. A fragipan in the lower part of the subsoil restricts the penetration of roots and the movement of air and water. Available moisture capacity is moderate, the content of organic matter is low, and natural fertility is moderate or moderately low.

These soils are easy to till and are suited to most crops commonly grown in the survey area, although some deep-rooted crops are short lived. Among the crops to which the soils are suited are corn, tobacco, soybeans, small grain (fig. 18), and grasses and legumes grown for hay and pasture. Kentucky 31 tall fescue, timothy, redtop, red clover, alsike clover, Ladino clover, and annual lespedeza are among the plants suitable for hay and pasture.

Erosion is not a hazard, and cultivated crops can be grown intensively. In most places artificial drainage is not needed. In a few low places, however, surface drainage would be desirable for some crops.

CAPABILITY UNIT IIw-3

The only soil in this unit is Henshaw silt loam. It is a deep, somewhat poorly drained, nearly level soil on stream terraces.

The surface layer is very friable silt loam, and the subsoil is silty clay loam. The water table is high in winter and in spring. Permeability is moderately slow, and available moisture capacity is high.

This soil is easy to till. It is suited to corn, soybeans, small grain, Kentucky 31 tall fescue, timothy, red clover, alsike clover, Ladino clover, and annual lespedeza.

Erosion is not a hazard in most places, and cultivated crops can be grown intensively. A few low areas are occasionally flooded, but most areas are above flood level. Artificial drainage increases the suitability of most areas of this soil for crops.

CAPABILITY UNIT IIs-1

Clifty gravelly loam is the only soil in this unit. It is a well-drained, nearly level soil on flood plains.

The surface layer of this soil contains enough gravel to interfere with tillage. The root zone is deep. Permeability is moderately rapid, and available moisture capacity is moderate. The content of organic matter is low, and natural fertility is moderately low. In areas that have not been limed, the surface layer is strongly acid or very strongly acid.

This soil can be used for all the crops commonly grown in the survey area. Among the crops to which it is suited are corn, tobacco, soybeans, wheat, Kentucky 31 tall fescue, redtop, orchardgrass, alfalfa, red clover, Ladino clover, and annual lespedeza.

Some areas of this soil are subject to flooding in winter and in spring. Erosion is not a hazard if row crops are grown.

CAPABILITY UNIT IIs-2

The only soil in this unit is Markland silt loam, 0 to 2 percent slopes. This soil is well drained or moderately well drained and is nearly level. It is on stream terraces.

This soil has a surface layer of silt loam, and it has a clayey subsoil. The root zone is deep, but the clayey subsoil resists the penetration of roots. Permeability is slow, and available moisture capacity is high. The content of organic matter is low, and natural fertility is moderately low. The surface layer is medium acid.

This soil is suited to most crops commonly grown in the survey area. It is well suited to corn, soybeans, Ken-

Figure 17.—**Area of Wakeland silt loam and of Patton silt loam, overwash, used to grow soybeans. Both soils are in capability unit IIw-1.**

tucky 31 tall fescue, redtop, orchardgrass, red clover, alsike clover, Ladino clover, and annual lespedeza. It is less well suited to wheat, tobacco, and alfalfa.

Erosion is not a hazard. Therefore, cultivated crops can be grown year after year.

CAPABILITY UNIT IIIe-1

This unit consists of deep sloping soils on stream terraces and uplands. These soils are in the Elk, Markland, Memphis, Shelocta, Wellston, and Wheeling series. All of these soils, except the Markland and Uniontown, are well drained, but the Markland and Uniontown soils are well drained or moderately well drained.

The surface layer is very friable silt loam, loam, or silty clay loam. All of the soils, except the Markland, have a loamy subsoil, are moderately permeable, and have high available moisture capacity. The Markland soil has a clayey subsoil, is slowly permeable, and has moderate available moisture capacity.

Soils of this unit are easy to till and are suited to most crops grown in the survey area. Among the field crops to which they are suited are corn, soybeans, tobacco, and small grain. Kentucky 31 tall fescue, orchardgrass, timothy, alfalfa, Ladino clover, red clover, and lespedeza are among the grasses and legumes to which the soils are suited.

Erosion is a severe hazard if these soils are used for cultivated crops. A suitable cropping system and erosion-control practices are needed to help to control runoff and erosion.

CAPABILITY UNIT IIIe-2

This unit consists of well drained or moderately well drained, sloping soils that have a fragipan. These soils are on uplands. They are in the Loring and Zanesville series.

The surface layer is very friable silt loam. The root zone is moderately deep. Permeability is moderate above the fragipan and is slow in the fragipan. Available moisture capacity and natural fertility are both moderate, and the content of organic matter is low.

Soils of this unit are easy to till and are suited to corn, tobacco, small grain, hay, and most other crops grown in the survey area. Among the pasture and meadow crops to which they are suited are Kentucky 31 tall fescue, orchardgrass, timothy, red clover, Ladino clover, and annual lespedeza.

Figure 18.—Area of Grenada silt loam, 0 to 2 percent slopes, used to grow small grain. This soil is in capability unit IIw-2.

Erosion is a hazard. Practices that help to control erosion are needed if cultivated crops are grown (fig. 19). Sod crops that provide a good cover of plants effectively protect these soils.

CAPABILITY UNIT IIIw-1

Poorly drained, nearly level soils of flood plains comprise this unit. These soils are in the Jacob, Melvin, and Waverly series.

The surface layer of the Jacob soil is silty clay loam, and the surface layer of the other soils is silt loam. Available moisture capacity is high, the content of organic matter is low, and natural fertility is moderate. These soils have a seasonal high water table. They are saturated to within about 6 inches of the soil surface during wet periods, usually in winter and in spring. The root zone is deep, except where the water table restricts the depth to which roots can effectively penetrate.

Unless artificial drainage is provided, these soils are poorly suited to most crops grown in the survey area. Because flooding is a hazard, some areas are suited only to annual crops in summer. Where drainage is adequate, the soils are suited to corn, soybeans, hay, and pasture. Among the hay and pasture plants to which adequately drained areas are suited are Kentucky 31 tall fescue, red-

Figure 19.—Pasture of Kentucky 31 tall fescue on a soil of capability unit IIIe-2. In the background is Jeffry Cliff on a soil of capability unit VIIe-1.

top, reed canarygrass, alsike clover, Ladino clover, and annual lespedeza.

These soils are not subject to erosion.

CAPABILITY UNIT IIIw-2

The only soil in this unit is McGary silt loam. This soil is nearly level and is somewhat poorly drained. It is on stream terraces.

The surface layer is silt loam, and the subsoil is silty clay. The root zone is deep. Water moves slowly through this soil, and available moisture capacity is high. The content of organic matter is low, and natural fertility is moderately low. This soil has a seasonal high water table in winter and in spring.

Among the crops to which this soil is suited are corn, soybeans, Kentucky 31 tall fescue, redtop, timothy, alsike clover, white clover, and annual lespedeza.

In most places erosion is not a hazard and cultivated crops can be grown intensively. A few low areas of this soil are infrequently flooded, but most areas are above the level reached by floodwaters.

CAPABILITY UNIT IIIw-3

This unit consists of somewhat poorly drained Calloway and Weinbach soils and of a poorly drained Ginat soil. These soils are nearly level. They are on stream terraces and uplands.

The surface layer is very friable silt loam. The root zone is only shallow or moderately deep because movement of water and the penetration of roots are restricted by a fragipan. During winter and spring, a seasonal high water table is at a depth of less than 18 inches from the soil surface. Available moisture capacity is moderate, the content of organic matter is low, and natural fertility is moderately low.

Soils of this unit are easy to till and are suited to most crops grown in the survey area. They are not suited to crops that require good drainage. Among the crops to which these soils are suited are corn, soybeans, Kentucky 31 tall fescue, Ladino clover, redtop, timothy, reed canarygrass, alsike clover, and annual lespedeza.

In most places erosion is not a hazard. Row crops can be safely grown in a short rotation. Artificial drainage improves suitability of these soils for most farm crops.

CAPABILITY UNIT IIIw-4

In this unit are poorly drained and very poorly drained, fine-textured, nearly level soils on flood plains. These soils are in the Karnak and Montgomery series. They have formed in sediment deposited in slack water.

The surface layer is silty clay, silt loam, or silty clay loam. Where the surface layer is silty clay, tillage is difficult, unless the soils are worked only when they have the optimum content of moisture. The root zone is deep, except where its depth is limited by a seasonal high water table. These soils are saturated during wet periods, usually in winter and in spring, and water moves slowly through the soil profile. Available moisture capacity is high, and natural fertility is high or very high. The surface layer is medium acid or slightly acid.

Where these soils are adequately drained, they are suited to corn, soybeans, Kentucky 31 tall fescue, Ladino clover, red clover, alsike clover, and Korean lespedza. Some areas that have not been drained are in trees.

Erosion is not a hazard, and row crops can safely be grown year after year. If these soils are adequately drained, they can be cultivated intensively. Flooding limits the use of some areas to annuals that mature in summer.

CAPABILITY UNIT IIIs-1

This unit consists of droughty, sandy soils that are excessively drained and nearly level. These soils are in the Bruno and Lakin series. The Bruno soil is on flood plains, and the Lakin soil is on stream terraces.

The surface layer is loose loamy fine sand. Water moves rapidly through the soil profile, and available moisture capacity is low. The root zone is deep. Natural fertility is moderately low or low, and the content of organic matter is low.

These soils are suited to deep-rooted plants and can be used for corn, small grain, Kentucky 31 tall fescue, sweetclover, alfalfa, and sericea lespedeza. In a few places near the Ohio River, trees are grown on the Bruno soil to protect that soil from scouring during floods.

Soils of this unit are not subject to erosion, but the Bruno soil is subject to flooding. Because of its loose consistence, the surface layer provides poor traction for power equipment and makes such equipment fairly difficult to operate.

CAPABILITY UNIT IVe-1

This unit consists of deep, strongly sloping, well-drained soils on uplands and foot slopes. These soils are in the Shelocta and Wellston series.

The surface layer is silt loam. The subsoil contains more clay than the surface layer, and the subsoil of the Shelocta soil contains some coarse fragments. Available moisture capacity is high, and the rate at which water moves through these soils is favorable. Natural fertility is moderate, and the content of organic matter is low.

These soils are easy to till and are suited to small grain, Kentucky 31 tall fescue, redtop, timothy, Ladino clover, and annual lespedeza. They are less well suited to corn and tobacco than to small grains and close-growing crops, but corn and tobacco can be satisfactorily grown.

If these soils are cultivated, the hazard of erosion is very severe. A suitable cropping system and suitable erosion-control practices are needed that help to control runoff and erosion.

CAPABILITY UNIT IVe-2

This unit consists only of the mapping unit Frondorf-Wellston silt loams, 12 to 20 percent slopes. These soils are well drained, and they are on uplands. The Frondorf soils are moderately deep and the Wellston soils are deep over bedrock.

The surface layer is very friable silt loam. The subsoil contains slightly more clay than the surface layer. The Frondorf soils have some coarse fragments in the subsoil. Water moves through these soils at a favorable rate, and the available moisture capacity is moderate to high. The content of organic matter is low, and natural fertility is moderately low or moderate.

These soils are easy to till, but they are better suited to sod crops than to crops that require tillage. Among the

grasses and legumes to which they are suited are Kentucky 31 tall fescue, redtop, timothy, Ladino clover, and annual lespedeza; but corn, tobacco, and small grain can also be grown.

The hazard of erosion is very severe if these soils are cultivated. If cultivated crops are grown, a suitable cropping system and erosion-control practices that help to control runoff and erosion are needed.

CAPABILITY UNIT IVe-3

This unit consists of deep, sloping, severely eroded soils on uplands and stream terraces. These soils are in the Elk, Memphis, Uniontown, and Wellston series. The Uniontown soil is well drained or moderately well drained, and the other soils are well drained.

All of the original surface layer of these soils has been lost through erosion, and the subsoil is exposed in most places. As a result, most of the soils have a surface layer of silty clay loam, but the Wellston soil has a surface layer of silt loam. Available moisture capacity is high, and permeability is moderate. The content of organic matter is very low. Natural fertility is moderate or moderately low.

These soils are slightly more difficult to till than are uneroded soils of the same series. They are suited to corn, tobacco, soybeans, and small grain. Because of past erosion and the hazard of further erosion, they are better suited to grasses and legumes grown for hay and pasture than to crops that require cultivation. Grasses and legumes to which these soils are suited are Kentucky 31 tall fescue, orchardgrass, timothy, annual lespedeza, and sericea lespedeza.

The effects of past erosion and the hazard of further erosion are the main limitations to use of these soils for crops. If practices are used that help to control runoff and erosion, row crops can be grown; but the cropping system should also include close-growing crops.

CAPABILITY UNIT IVe-4

This unit consists of well drained or moderately well drained, sloping, severely eroded soils of the uplands. These soils are in the Loring and Zanesville series.

Erosion has removed most of the original surface layer of these soils. The present plow layer is composed mainly of material from the subsoil and is silty clay loam or silt loam. Roots and moisture readily penetrate the upper part of the subsoil, but further penetration is restricted by the fragipan in the subsoil. Available moisture capacity is moderate, the content of organic matter is very low, and natural fertility is moderately low.

These soils are suited to corn, tobacco, and small grain, but they are better suited to grasses and legumes grown for hay and pasture than to crops that require cultivation. Grasses and legumes to which these soils are suited are Kentucky 31 tall fescue, redtop, orchardgrass, timothy, annual lespedeza, and sericea lespedeza.

Further erosion is a very severe hazard if these soils are cultivated. Row crops can be grown if the cropping system also includes sod crops and if practices are used that help to control erosion.

CAPABILITY UNIT VIe-1

This unit consists of strongly sloping and moderately steep soils on uplands and stream terraces. These soils are in the Elk, Loring, Markland, Memphis, and Wellston series. The Loring and Markland soils are well drained or moderately well drained, and the other soils are well drained.

The surface layer of these soils is silt loam, and the subsoil contains more clay than the surface layer. Available moisture capacity is moderate or high. All of the soils, except the Loring, have a deep root zone, but the Loring soil has a root zone that is only moderately deep over a fragipan. Except in the Loring soil, where penetration of roots and the movement of water are restricted by the fragipan, roots and moisture penetrate the soils at a favorable rate.

Soils of this unit are suited to permanent vegetation of hay, pasture, or trees. They can be used for most of the grasses and legumes commonly grown in the survey area. Among the plants to which they are suited are Kentucky 31 tall fescue, annual lespedeza, and sericea lespedeza. Other grasses and legumes to which these soils are fairly well suited are alfalfa, orchardgrass, redtop, timothy, Ladino clover, and sweetclover.

Erosion is a hazard in areas not protected by a cover of plants. Therefore, these soils are not suited to row crops. They should be seeded to grasses and legumes that provide a good cover for the soils and that thus help to control runoff and erosion. The most desirable plants for hay or pasture are ones that require only infrequent renovation.

CAPABILITY UNIT VIe-2

This unit consists only of the mapping unit Frondorf-Wellston silt loams, 20 to 30 percent slopes. These soils are well drained and are on uplands. The Frondorf soils are moderately deep, and the Wellston soils are deep.

The surface layer is very friable silt loams, and the subsoil contains more clay than the surface layer. The Frondorf soils have some coarse fragments in the subsoil. Water moves through these soils at a favorable rate, and available moisture capacity is moderate to high. The content of organic matter is low.

These soils are suited to permanent vegetation of hay, pasture, or trees. They are well suited to Kentucky 31 tall fescue and sericea lespedeza and are fairly well suited to timothy, orchardgrass, annual lespedeza, Ladino clover, red clover, and redtop.

Because these soils are subject to erosion, they are not suited to row crops. The soils should be protected by a good cover of plants at all times. Plants selected for seeding for hay or pasture should be ones that are long lived, that provide a good sod, and that do not require frequent renovation.

CAPABILITY UNIT VIe-3

This unit consists of severely eroded Markland, Frondorf, Loring, Memphis, and Wellston soils of uplands and stream terraces. The Markland soil is sloping; the Frondorf soils are strongly sloping; and the Loring, Memphis, and Wellston soils are strongly sloping to moderately steep. Except for the Loring and Markland soils, which are well drained or moderately well drained, all of these soils are well drained.

The Markland soils has a surface layer of silty clay, and the other soils have a surface layer of silt loam or silty clay loams. The Frondorf soils have some coarse

fragments in the subsoil. The root zone of the Frondorf and Loring soils is moderately deep, and the root zone of the other soils is deep. Permeability is moderate throughout the root zone, and available moisture capacity is moderate to high. The content of organic matter is very low, and natural fertility is low or moderately low.

The Markland soil is somewhat difficult to till, but the other soils can be tilled more easily. Plants to which these soils are suited are Kentucky 31 tall fescue, annual lespedeza, sericea lespedeza, and bermudagrass. Plants to which the soils are fairly well suited are Ladino clover, timothy, red clover, sweetclover, and redtop. These soils are also suitable for trees.

Further erosion is a serious hazard. Therefore, soils of this unit are not suited to row crops, but they can be used for pasture. A good cover of plants should be kept on the soils at all times. Desirable mixtures selected for seeding are ones that consist of grasses and legumes capable of providing satisfactory yields of forage and that require only infrequent renovation.

CAPABILITY UNIT VIIe-1

This unit consists of well-drained, moderately steep and steep soils of uplands. These soils are in the Frondorf, Memphis, and Wellston series.

The surface layer is silt loam, and these soils have a subsoil that contains more clay than the surface layer. The Frondorf soils have some coarse fragments in the subsoil. They have a moderately deep root zone, and the other soils have a deep root zone. All the soils have moderate permeability and moderate to high available moisture capacity. Natural fertility is moderate to moderately low, and the content of organic matter is low.

These soils are suited to trees and other permanent vegetation. They are not suited to cultivated crops, because of the hazard of erosion when the soils are not protected by a cover of plants. Grasses and legumes to which the soils are suited are Kentucky 31 tall fescue, sericea lespedeza, and bermudagrass. Some areas are suited only to trees.

In some places a stand of grasses and legumes can be kept on these soils and can be used for hay and pasture. Protecting the soils with a good cover of plants is important. In places rock outcrops, stones, or steep slopes make the use of farm machinery difficult or practically impossible.

CAPABILITY UNIT VIIe-2

This is a unit of severely eroded soils. In it are the land type Gullied land and soils of the Frondorf, Wellston, and Markland series. The Frondorf and Wellston soils are moderately steep, and the Markland soil is strongly sloping and moderately steep. The Frondorf soils are moderately deep and well drained; the Wellston soils are deep and well drained; and the Markland soil is deep and is moderately well drained or well drained.

Erosion has removed the original surface layer of the Frondorf, Wellston, and Markland soils. In most places the subsoil is exposed, and there are rills and shallow gullies in some areas. The present surface layer of the Frondorf and Wellston soils is silt loam. The surface layer of the Markland soil is silty clay. Gullied land is so severely eroded that the original soils have been destroyed throughout a large part of the acreage. Therefore, characteristics of that land type are variable.

Soils of this unit can be used for permanent vegetation. They are suited to Kentucky 31 tall fescue and sericea lespedeza, and they are fairly well suited to redtop, timothy, bermudagrass, and Ladino clover. Gullied land requires grading and smoothing before it can be crossed with farm machinery.

Further erosion is a very severe hazard. Therefore, soils of this unit are not suited to row crops. Most of the areas were formerly cultivated, but many of them are now revegetating naturally and are reverting to trees. Keeping a good cover of plants in areas used for hay and pasture is important. Plants selected for seeding for hay and pasture should be ones that make a dense stand that will help to control runoff and erosion. Many areas of these soils are more suitable for trees and for wildlife habitat than for other uses.

CAPABILITY UNIT VIIe-3

Only the mapping unit Alluvial land, steep, is in this unit. This land type consists mainly of mixed, undifferentiated sediment on streambanks, mostly along the Ohio and the Green Rivers. Most areas are flooded each year, and a few low areas are flooded several times in some years. This land type ranges from nearly level to steep; the low areas that are flooded frequently are nearly level, and areas where streams have cut into the banks are steep and resemble cliffs. Slopes are mainly between 20 and 50 percent.

This land is better suited to trees than to field crops or crops grown for hay and pasture. Trees help to reduce cutting of the streambanks, and they keep sand from being deposited over productive soils. Most areas provide food and cover for wildlife. Some are used as campsites and for recreation.

CAPABILITY UNIT VIIs-1

Only the mapping unit Strip mine spoil is in this unit. It consists of rocks, coal, and soil material moved in the mining of coal. In most places the overburden over the coal has been moved by using large earthmoving equipment. Except in a few areas that have been leveled, the overburden has been placed in piles that have steep sides.

The material of which Strip mine spoil is composed consists mostly of broken pieces of sandstone, siltstone, shale, and limestone ranging from 1 inch to 3 feet in diameter. Mixed with these fragments are the pieces of coal and the soil material that were originally above the bedrock. In places acid water that is toxic to plant and marine life drains from the areas. Pits that are left after the coal and overburden have been removed generally hold water.

Most areas of Strip mine spoil can be used for trees, but results are variable. Areas that have been leveled support a sparse stand of grasses and legumes, but preparation of the seedbed is difficult or impossible because of the coarse fragments. Areas that have not been leveled are too rough and too steep for the use of farm equipment. Most areas support a sparse cover of plants that provide some cover for wildlife.

Estimated yields

Table 2 gives estimated average acre yields of the crops most commonly grown in Daviess and Hancock Counties under two levels of management. Yields for a medium level of management are shown in columns A. Those for a high level of management are shown in columns B.

These yields are averages that can be expected over a period of several years. Yields for 1 year may be low because they are adversely affected by extremes of weather, insects and diseases, or some other disaster. On the other hand, yields for another year may be extremely high because of a combination of favorable factors.

Comparison of yields in columns A with those in columns B shows differences that can be expected by improving management. Yields for tobacco are for only a high level of management because this level is nearly always used.

A high level of management consists of: (1) planting suitable varieties of crops; (2) seeding at the proper rates, inoculating legumes, planting on suitable dates, and using efficient harvesting methods; (3) controlling weeds, insects, and plant diseases; (4) applying a suitable fertilizer in amounts equal to or greater than the current recommendations of the University of Kentucky Agricultural Experiment Station, or equal to or greater than the need shown by properly interpreted soil tests; (5) applying an adequate amount of lime where needed; (6) providing drainage for naturally wet soils that are feasible to drain; (7) choosing a cropping system that helps to control erosion, that maintains favorable soil structure and good tilth, and that adds to the supply of organic matter; (8) applying such practices as contour tillage, terracing, contour stripcropping, and sod waterways to help to control erosion; (9) using cover crops and crop residue to add to the supply of organic matter and to reduce erosion; (10) using all applicable pasture management practices; and (11) keeping tillage to a minimum, interseeding winter crops in row crops, and using other desirable management practices.

The high level of management described in the preceding paragraph is not the maximum level possible, but it is a level that is practical for many farmers to achieve. It results in the highest sustained yields that are economically feasible to obtain. Failure to adequately apply one or more of the practices listed for a high level of management can cause production to drop to an unprofitable level, and it may result in some permanent damage to the soils.

The medium level of management generally consists of the minimum fertilization and management that will protect the soils and yet produce enough returns for some profit. Supplying inadequate drainage, failing to control runoff, and failing to use adequate erosion-control practices are examples of deficiencies that reduce management to a medium level.

Use of the Soils as Woodland [3]

This section describes the woodland in Daviess and Hancock Counties. It also explains woodland suitability grouping of soils and provides, in table 3, information about the woodland suitability groups in these two counties.

Originally, the area that is now Daviess and Hancock Counties was covered by a hardwood forest consisting mainly of oak, hickory, yellow-poplar, maple, beech, and sweetgum. A few small areas of lowland probably had a cover of plants, mostly cane, sedges, and water grasses. The first areas cleared by settlers were mainly on uplands and on other high places near the Ohio River. Areas containing steep or stony soils, and those containing outcrops of rock, were left in forest.

Since about 1900, the population on farms in the hilly parts of Daviess and Hancock Counties has declined, and areas formerly used for crops are reverting to forest. According to records of the U.S. Bureau of the Census, about 70,000 acres, or 23 percent of Daviess County, and about 56,300 acres, or 47 percent of Hancock County, was in forest in 1970. About three-fourths of the acreage in commercial forests is occupied by oak-hickory or central mixed hardwood forest types. About one-third of the acreage of commercial forests is well stocked with merchantable or potentially merchantable trees. About 16 percent of the acreage of these forests is well stocked with desirable trees, and in those places the forests are highly productive.

The forests of these two counties are adequately protected from fire. They are capable of producing 50 to 85 cubic feet of wood per acre each year instead of the current average yield of 30 cubic feet per acre. To realize this potential, it is necessary to improve the growing stock of desirable species of trees and to relate management to features that affect the productivity potential of the soils.

Soil properties strongly influence adaptation of species of trees, the growth of trees, and the woodland management required. Differences in the depth and texture of the soils affect the available water capacity and thereby influence the growth of trees. Such other features as slope and aspect also account for differences in the growth of trees.

Woodland suitability grouping of soils

As a rule, growth of trees is about the same on soils that have similar properties. For this reason, it is possible to place soils in groups for woodland management. Each group consists of soils on which similar wood crops are produced, that need similar management for these crops to be produced, and that have about the same potential for growing trees. Such a group is called a woodland suitability group.

The "Guide to Mapping Units" at the back of this survey shows the woodland suitability group for each mapping unit suited to trees in Daviess and Hancock Counties. Table 3 describes each woodland suitability group according to potential productivity, including site index and annual growth per acre; indicates the severity of hazards and limitations to management; and provides names of species of trees to favor in existing stands and names of trees to favor for planting.

Potential productivity, as used in table 3, refers to the capability of a soil to produce wood crops. The best indicator of soil productivity is the average height to which the tallest trees will grow in a stated number of years.

[3] Prepared in collaboration with CHARLES A. FOSTER, woodland conservationist, Soil Conservation Service.

TABLE 2.—*Estimated average yields per acre of the principal crops grown under two levels of management*

[Yields in columns A are those to be expected under a medium level of management; those in columns B, under a high level of management. Absence of a yield value indicates that the crop is not suited to or is not grown on the soil at the stated level of management. The land types Alluvial land, steep (AlF), Gullied land (Gu), Strip mine spoil (St), and Urban land (Ur) are not used for crops and are omitted from this table]

Mapping unit	Corn		Soybeans		Wheat		Tobacco	Hay: Alfalfa and grass		Hay: Annual lespedeza (Korean or Kobe)		Hay: Red clover and grass		Pasture (tall fescue and a legume)	
	A	B	A	B	A	B	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow acre days* [1]	*Cow acre days* [1]
Ashton silt loam	70	110	35	45	25	40		4.0	5.0	2.0	2.5	3.0	3.5		
Belknap silt loam	65	100	25	40	20	35	2,525			2.5	3.0	2.0	3.0	150	230
Bruno loamy fine sandy	60	90	25	30						1.5	2.0				
Calloway silt loam	55	80	25	30	15	25				2.0	2.5	2.0	3.0	150	200
Clifty gravelly loam	80	120	30	40	30	45	3,100	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Collins silt loam	80	120	30	45	25	40	3,000	4.0	5.0	2.5	3.0	3.5	3.5	200	285
Elk silt loam, 0 to 2 percent slopes	80	120	30	40	30	45	3,200	4.0	5.0	2.0	2.5	3.0	4.0	200	285
Elk silt loam, 2 to 6 percent slopes	80	120	30	40	30	45	3,100	4.0	5.0	2.0	2.5	3.0	4.0	200	285
Elk silt loam, 6 to 12 percent slopes	70	105	25	35	30	40	2,800	3.5	4.5	2.0	2.5	3.0	3.5	175	255
Elk silt loam, 12 to 50 percent slopes										1.5	2.0			150	200
Elk silty clay loam, 6 to 12 percent slopes, severely eroded	60	95	15	25	15	25	2,300	3.0	4.0	1.5	2.0			150	230
Frondorf-Wellston silt loams, 12 to 20 percent slopes					15	25	1,600			1.5	2.0	2.0	2.5	125	170
Frondorf-Wellston silt loams, 12 to 20 percent slopes, severely eroded														100	145
Frondorf-Wellston silt loams, 20 to 30 percent slopes														100	145
Frondorf-Wellston silt loams, 20 to 30 percent slopes, severely eroded														75	115
Frondorf-Wellston silt loams, 30 to 50 percent slopes															
Ginat silt loam	45	70	20	30						1.5	2.0			150	200
Grenada silt loam, 0 to 2 percent slopes	60	80	20	30	30	40	2,350	3.0	3.5	2.0	2.5	2.0	3.0	150	200
Grenada silt loam, 2 to 6 percent slopes	65	80	20	30	30	40	2,550	3.0	3.5	2.0	2.5	2.0	3.0	150	200
Henshaw silt loam	70	100	30	45	30	45	2,525			2.0	2.5	2.0	3.0	175	255
Huntington silt loam	85	120	35	45	35	45	3,200	4.0	5.0	2.5	3.0	3.0	3.5	200	285
Jacob silty clay loam	50	75	20	30		25				1.5	2.0			150	230
Karnak silt loam, overwash	70	100	25	35	20	35				1.5	2.0	2.0	3.0	175	230
Karnak silty clay	70	100	25	35	20	35				1.5	2.0	2.0	3.0	175	230
Lakin loamy fine sand, 0 to 2 percent slopes	50	70	25	35	30	35	1,800			1.5	2.0			100	170
Lindside silt loam	80	120	30	45	25	40	2,900	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Loring silt loam, 0 to 2 percent slopes	65	95	25	35	30	40	2,750	3.0	4.0	2.0	2.5	2.0	3.0	170	230
Loring silt loam, 2 to 6 percent slopes	65	95	25	35	30	40	2,750	3.0	4.0	2.0	2.5	2.0	2.5	170	230
Loring silt loam, 6 to 12 percent slopes	60	85	25	35	30	35	2,450	3.0	4.0	2.0	2.5	2.0	2.5	170	230
Loring silt loam, 12 to 25 percent slopes										1.5	2.0			150	200
Loring silty clay loam, 6 to 12 percent slopes, severely eroded	50	75	20	30	20	30	1,875			1.5	2.0			100	200
Loring silty clay loam, 12 to 25 percent slopes, severely eroded														100	145
McGary silt loam	45	70	25	35	25	35	2,000			1.5	2.0			150	200
Markland silt loam, 0 to 2 percent slopes	45	80	10	20	20	30	2,450	2.5	3.5	1.5	2.0	2.0	3.0	125	200
Markland silt loam, 12 to 30 percent slopes										1.5	2.0			100	170
Markland silty clay loam, 2 to 6 percent slopes, eroded	50	85	15	30	25	35	2,400	2.5	3.5	1.5	2.0	2.0	2.5	125	200
Markland silty clay, 6 to 12 percent slopes, severely eroded										1.0	1.5			100	145
Markland silty clay, 12 to 30 percent slopes, severely eroded														110	
Melvin silt loam	40	75	20	30						1.5	2.0			150	230
Memphis silt loam, 0 to 2 percent slopes	80	120	30	45	30	40	3,200	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Memphis silt loam, 2 to 6 percent slopes	80	120	30	45	30	40	3,200	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Memphis silt loam, 6 to 12 percent slopes	60	95	30	35	30	40	2,900	3.5	4.5	2.0	2.5	3.0	3.5	175	255
Memphis silt loam, 12 to 30 percent slopes										1.5	2.0			125	200
Memphis silt loam, 30 to 60 percent slopes														115	170

See footnote at end of table.

TABLE 2.—*Estimated average yields per acre of the principal crops grown under two levels of management*—Continued

Mapping unit	Corn		Soybeans		Wheat		Tobacco	Hay: Alfalfa and grass		Hay: Annual lespedeza (Korean or Kobe)		Hay: Red clover and grass		Pasture (tall fescue and a legume)	
	A	B	A	B	A	B	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow acre days* [1]	*Cow acre days* [1]
Memphis silty clay loam, 6 to 12 percent slopes, severely eroded	50	80	20	25	20	30	2,400	----	----	1.5	2.0	----	----	100	170
Memphis silty clay loam, 12 to 30 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----	----	----	----	100	170
Montgomery silty clay loam	60	80	25	35	----	----	----	----	----	2.0	2.5	3.0	3.5	175	230
Newark silt loam	60	100	30	40	20	35	----	----	----	2.0	2.5	2.0	3.0	150	230
Otwell silt loam, 0 to 2 percent slopes	65	90	30	35	25	35	2,450	3.0	3.5	1.5	2.0	2.0	3.0	150	200
Otwell silt loam, 2 to 6 percent slopes	70	90	30	35	25	40	2,700	3.0	3.5	1.5	2.0	2.0	3.0	150	200
Patton silt loam	65	100	30	40	----	40	----	----	----	2.0	2.5	3.0	3.5	175	255
Patton silt loam, overwash	70	100	30	40	----	40	----	----	----	2.0	2.5	3.0	3.5	175	255
Sciotoville loam, 0 to 2 percent slopes	65	90	30	35	25	35	2,450	3.0	3.5	1.5	2.0	2.0	3.0	150	200
Shelocta silt loam, 6 to 12 percent slopes	60	85	25	35	25	35	2,450	3.5	4.0	1.5	2.0	3.0	3.5	175	230
Shelocta silt loam, 12 to 25 percent slopes	50	70	----	----	20	30	----	----	----	1.5	2.0	----	----	125	170
Uniontown silt loam, 0 to 2 percent slopes	70	115	30	40	35	45	2,750	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Uniontown silt loam, 2 to 6 percent slopes	70	110	25	40	35	45	2,800	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Uniontown silty clay loam, 6 to 12 percent slopes, severely eroded	50	75	15	25	20	30	2,100	3.0	4.0	1.5	2.0	----	----	150	230
Wakeland silt loam	70	105	25	40	20	35	2,525	----	----	2.0	2.5	2.0	3.0	150	230
Waverly silt loam	40	75	15	30	----	25	----	----	----	1.5	2.5	----	----	150	230
Weinbach silt loam	50	100	20	30	25	35	----	----	----	1.5	2.0	2.0	3.0	150	230
Wellston silt loam, 6 to 12 percent slopes	45	85	25	35	25	35	2,450	3.5	4.0	2.0	2.5	3.0	3.5	175	230
Wellston silt loam, 6 to 12 percent slopes, severely eroded	35	75	20	30	20	30	1,500	----	----	1.5	2.0	----	----	125	200
Wellston silt loam, 12 to 20 percent slopes	35	70	----	----	20	30	1,600	----	----	1.5	2.0	----	----	125	200
Wellston silt loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	125	170
Wellston silt loam, 12 to 30 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----	----	----	----	75	----
Wheeling loam, 0 to 2 percent slopes	60	110	25	35	30	40	3,000	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Wheeling loam, 2 to 6 percent slopes	60	110	25	35	30	40	2,900	4.0	5.0	2.0	2.5	3.0	3.5	200	285
Wheeling loam, 6 to 12 percent slopes	50	95	20	30	25	35	2,700	4.0	4.5	1.5	2.0	3.0	3.5	200	255
Wilbur silt loam	90	120	30	45	25	40	3,800	4.0	5.0	2.5	3.0	3.0	3.5	200	285
Zanesville silt loam, 2 to 6 percent slopes	50	90	25	35	25	35	2,675	3.0	3.5	2.0	2.5	2.5	3.0	150	200
Zanesville silt loam, 6 to 12 percent slopes	45	80	20	30	20	30	2,375	3.0	3.5	2.0	2.5	2.0	3.0	150	200
Zanesville silt loam, 6 to 12 percent slopes, severely eroded	40	60	----	----	15	25	1,875	----	----	1.5	2.0	----	----	100	170

[1] Cow-acre-days is the number of days that 1 acre of pasture can be grazed without damage by one animal unit (one cow, steer, or horse, five hogs, or seven sheep).

This average height in feet for a specified age is called *site index.* For most species of trees studied in these two counties, the site index is based on the average height of trees at age 50 years. Average measurements for height and age for species of trees studied in the two counties were converted to site index by using published results of research, including site index curves (*4*, *5*, *6*, *8*, *14*, and *20*). Also used were unpublished results of field studies made of 271 sample plots by the Tennessee Valley Authority to determine the site indexes for eastern redcedar. Predictions of average annual growth were based on published data (*12*, *14*, *16*, *20*, and *21*) and on evaluations made by the Soil Conservation Service. In table 3 productivity ratings are expressed as a range of site indexes.

In gathering data from which to determine the site indexes, many trees in and near Daviess and Hancock Counties were measured. As nearly as possible, the measurement studies were confined to well-stocked, naturally occurring, unmanaged, even-aged stands that had not been adversely affected by fire, insects, or diseases.

On such soils as those of the Frondorf series, trees on north- and east-facing slopes have higher productivity than those on south- and west-facing slopes. Slopes that face southeast and clockwise to northwest are said to have a south and west aspect; those facing northwest and clockwise to southeast have a north and east aspect. Because of differences in productivity, areas of these mapping units that have different aspects are placed in different woodland suitability groups.

Woodland suitability groups are identified by use of connotative symbols, each of which is composed of three elements, as follows:

The first element is an Arabic numeral that indicates the relative productive potential of the soils in the group

for growing wood crops. The soils of Daviess and Hancock Counties are placed in potential productivity classes 1 through 4. The numeral 1 indicates very high potential productivity; 2, high potential productivity; 3, moderate potential productivity; and 4, low potential productivity.

The second element is a lowercase letter that refers to a soil characteristic that limits use or management of woodland. In these two counties, hazards recognized are represented by letters *w*, *c*, *s*, *r*, and *o*, which have the following meanings: *w*, excessive wetness; *c*, clayey material in the soil profile; *s*, sandy material in the soil profile; *r*, relief or steepness of slope; and *o*, no significant soil-related hazards or limitations.

The third element, also an Arabic numeral, is part of the statewide numbering system that identifies the group for preferred species of trees and the kinds of management needed.

Erosion hazard is the degree of potential soil erosion that may occur in a well-managed area of woodland after the trees have been cut or in places where the soil is exposed along roads, skid trails, fire lanes, and landing areas. Soil characteristics or properties considered in determining the hazard of erosion are slope, rate of infiltration, permeability of the subsoil, water-storage capacity, and resistance to detachment of soil particles by the forces exerted by rainfall and runoff. A rating of *slight*, *moderate*, or *severe* was given to indicate the hazard of erosion. A rating of *slight* indicates that no special measures are needed to protect the soils; a rating of *moderate* indicates that some attention must be given to preventing unnecessary soil erosion; and a rating of *severe* indicates that intensive measures, specialized equipment, and suitable methods of operation must be used to minimize the hazard of soil erosion.

Equipment limitation is influenced by such soil characteristics as slope, drainage, texture, stoniness, and rockiness. These features can restrict the use of conventional wheel-type or track-type equipment for planting trees and harvesting wood crops, for constructing roads, and for controlling fires and unwanted vegetation. Topographic conditions or differences in soils may necessitate the use of a different kind of equipment and method of operation, or they may necessitate varying the season when equipment is used.

Equipment limitation is *slight* where the slope is 20 percent or less, where soil wetness is not a limitation, and where farm machinery can be operated efficiently without need for constructing and maintaining permanent roads and trails for trucks. The limitation is *moderate* where the slope is 20 to 30 percent, where the use of ordinary farm mahcinery is limited, where track-type equipment is necessary for efficient harvesting, or where soil wetness prevents the use of logging equipment for a period 2 to 6 months. The limitation is *severe* where the slope is steeper than 30 percent, where track-type equipment is not adequate for harvesting, where power vehicles and other special equipment is needed, or where wetness prevents the use of equipment for a period of 6 months or more.

Seedling mortality refers to the expected loss of naturally occurring or planted tree seedlings and is influenced by such characteristics of the soil as drainage, effective root depth, texture of the surface layer, and aspect. Plant competition is not a factor in the ratings. *Slight* mortality means that the expected loss is 0 to 25 percent; *moderate* mortality, that the expected loss is 25 to 50 percent; and *severe* mortality, that the expected loss is more than 50 percent. If the rating is moderate or severe, replanting is likely to be necessary to insure a fully stocked stand, and special preparation of the seedbed and special planting techniques are likely to be required.

Plant competition refers to the invasion of unwanted trees, vines, shrubs, and other plants on a site where openings have been made in the overhead canopy. This competition hinders the establishment and normal development of desirable seedlings, whether the seedlings occur naturally or are planted. Plant competition is influenced by soil drainage, natural fertility, acidity, and light requirement. Plant competition is *slight*, where unwanted plants do not prevent adequate natural regeneration, do not interfere with early growth of seedlings, or do not restrict the normal development of planted stock. It is *moderate* where unwanted plants delay establishment and hinder the growth of either planted or naturally regenerated seedlings, or if such growth retards the eventual development of a fully stocked stand. Competition is *severe* where unwanted plants prevent adequate restocking, either by natural regeneration or by planting, without intensive preparation of the site, or without special maintenance practices.

Use of the Soils for Wildlife

The welfare of a specific kind of wildlife depends largely on the amount and distribution of food, shelter, and water. If any of these elements is missing, is inadequate, or is inaccessible, that particular kind of wildlife is absent or scarce. The kinds of wildlife that live in a given area, and the abundance of each kind, are closely related to land use, to the resulting kinds and patterns of vegetation, and to the supply and distribution of water. These, in turn, are generally related to the kinds of soils.

Habitat for wildlife generally can be created or improved by planting suitable vegetation, by properly managing the existing cover of plants, by fostering the natural establishment of desirable plants, or by using a combination of these measures (*1*).

The soils of Daviess and Hancock Counties are rated in table 4 according to their suitability for eight elements of wildlife habitat and for three classes of wildlife. The suitability ratings in this table can be used as an aid in—

1. Planning the broad use of parks, refuges, nature-study areas, and other recreational developments for wildlife habitat.
2. Selecting the most suitable soils for creating, improving, or maintaining specific kinds of elements of wildlife habitat.
3. Determining the relative intensity of management needed for individual elements of wildlife habitat.
4. Eliminating sites that would be difficult or not feasible to manage for specific kinds of wildlife.
5. Determining areas that are suitable for acquisition for use by wildlife.

TABLE 3.—*Woodland interpretations*

[The land types Gullied land (Gu), Strip mine spoil (St), and Urban land (Ur) are not placed in a woodland suitability

Woodland suitability group and description of soils	Soils in group	Potential productivity			Management hazards or limitations	
		Species	Site index	Annual growth per acre [1]	Soil erosion	Equipment limitation
				Bd. Ft. [2]		
Group 1o1: Well-drained, nearly level soils, dominantly on flood plains; very high productivity potential.	Ashton: As. Clifty: Cg. Huntington: Hu.	Upland oaks Lowland oaks Yellow-poplar	85+ 95+ 95+	350+ 450+ 500+	Slight	Slight
Group 1w1: Moderately well drained to somewhat poorly drained, nearly level soils on flood plains and stream terraces; very high productivity potential.	Belknap: Be. Calloway: Ca. Collins: Co. Henshaw: He. Lindside: Ld. Newark: Ne. Wakeland: Wa. Weinbach: Wh. Wilbur: Wu.	Lowland oaks Yellow-poplar Sweetgum	95+ 95+ 95+	450+ 500+ 500+	Slight	Moderate
Group 1w2: Poorly drained, nearly level soils; very high productivity potential.	Ginat: Gn. Jacob: Ja. Karnak: Ka, Kc. Melvin: Mh. Montgomery: Mo. Patton: Pa, Ph. Waverly: We.	Lowland oaks Sweetgum	95+ 95+	450+ 500+	Slight	Severe
Group 2o1: Dominantly well-drained, nearly level to steep soils on uplands and stream terraces; high productivity potential.	Elk: EkA, EkB, EkC, EkE. Memphis: MmA, MmB, MmC, MmE, MmF. Shelocta: ShC, ShD. Uniontown: UnA, UnB. Wellston: WlC, WlD, WlE. Wheeling: WnA, WnB, WnC.	Upland oaks Virginia pine Shortleaf pine Yellow-poplar	75–85 75–85 75–85 85–95	240–350 540–650 670–820 380–500	Slight to moderate.	Slight to moderate.
Group 2c1 Well drained or moderately well drained, nearly level to moderately steep soils on uplands; clayey subsoil; high productivity potential.	Markland: MdA, MdE, MeB2.	Upland oaks Virginia pine Yellow-poplar	75–85 75–85 85–95	240–350 540–650 380–500	Moderate to severe.	Moderate to severe.
Group 3o1: Dominantly well-drained, sloping to moderately steep soils and moderately well drained or well drained soils that have a fragipan; moderate productivity potential.	Elk: ElC3. Frondorf: [3] FwD. Grenada: GrA, GrB. Loring: LoA, LoB, LoC, LoD. Memphis: MnC3, MnE3. Otwell: OtA, OtB. Sciotoville: ScA. Uniontown: UoC3. Wellston: WlC3, WlE3. Zanesville: ZaB, ZaC.	Upland oaks Yellow-poplar Loblolly pine	65–75 75–85 75–85	160–240 280–390 570–740	Slight to moderate.	Slight to moderate.

See footnotes at end of table.

by suitability groups

group because these areas are variable and require onsite examination for management]

Management hazards or limitations—Continued			Species suitability—			
Seedling mortality	Plant competition		To favor in existing stands			For planting
	Coniferous	Hardwood	Desirable	Acceptable	Less desirable	
Slight	Severe	Moderate	Yellow-poplar, black walnut, sweetgum, white oak, cherrybark oak, cottonwood, northern red oak.	Elm, white ash, hickory.	Hackberry, blackgum, boxelder, red maple.	Yellow-poplar, black walnut, white ash, cottonwood, cherrybark oak, white pine, black locust, loblolly pine, shortleaf pine.
Slight	Severe	Severe	White ash, white oak, sweetgum, cherrybark oak, cottonwood, Shumard oak, yellow-poplar, black oak.	Southern red oak, pin oak, hickory, black cherry, sugar maple, sycamore.	Hackberry, blackgum, elm, red maple.	White ash, sweetgum, cottonwood, yellow-poplar, cherrybark oak, loblolly pine.
Severe	Severe	Severe	Pin oak, sweetgum, white oak, white ash, cottonwood, cherrybark oak, sycamore.	Black oak, sugar maple, hickory.	River birch, willow, elm, silver maple, red maple, hackberry.	Sweetgum, pin oak, loblolly pine, sycamore.
Slight	Severe	Moderate	Yellow-poplar, sweetgum, white oak, white ash, black walnut.	Black oak, sugar maple, hickory, southern red oak, post oak, black cherry.	Beech, sassafras, red maple, elm, blackgum.	Yellow-poplar, black walnut, white pine, white oak, white ash, loblolly pine, shortleaf pine, black locust.
Slight	Severe	Moderate	Northern red oak, yellow-poplar, black walnut, white oak, black oak.	Scarlet oak, white ash, beech, hickory.	Red maple, blackgum, buckeye, redcedar, elm.	White ash, yellow-poplar, white pine, shortleaf pine, Virginia pine, white oak, black locust.
Slight to moderate.	Moderate	Slight	Yellow-poplar, white oak, northern red oak, Shumard oak.	Pin oak, sycamore, hickory, black oak, black cherry, scarlet oak, sugar maple.	Red maple, sassafras, hackberry, blackgum, elm.	Loblolly pine, shortleaf pine, Virginia pine, white oak, white pine, black locust.

TABLE 3.—*Woodland interpretations*

Woodland suitability group and description of soils	Soils in group	Potential productivity			Management hazards or limitations	
		Species	Site index	Annual growth per acre [1]	Soil erosion	Equipment limitation
				Bd. Ft. [2]		
Group 3r1: Well-drained, moderately steep to steep soils that have north- and east-facing slopes; moderate productivity potential.	Frondorf: [3] FwE, FwF (northerly aspects).	Upland oaks Yellow-poplar	65–75 75–85	160–240 280–390	Moderate to severe.	Moderate to severe.
Group 3s1: Dominantly nearly level to steep, droughty, sandy soils and Alluvial land; moderate productivity potential.	Alluvial land, steep: AlF. Bruno: Bu. Lakin: LaA.	Upland oaks	65–75	160–240	Slight to moderate.	Moderate to severe.
Group 3w1: Somewhat poorly drained, nearly level soil that has a clayey subsoil; moderate productivity potential.	McGary: Mc.	Upland oaks Sweetgum	65–75 75–85	160–240 280–390	Slight	Moderate
Group 3c1: Well drained to moderately well drained, gently sloping to moderately steep, severely eroded soils that have a clayey subsoil; moderate productivity potential.	Markland: MfC3, MfE3.	Upland oaks Redcedar	65–75 45–55	160–240 ----------	Slight to severe.	Moderate to severe.
Group 4o1: Well drained or moderately well drained, sloping to strongly sloping, severely eroded soils; low productivity potential.	Frondorf: [4] FwD3. Loring: LrC3, LrD3. Zanesville: ZaC3.	Upland oaks Loblolly pine	55–65 65–75	90–160 440–570	Slight to moderate.	Slight
Group 4r1: Well-drained, moderately steep, severely eroded soils and well-drained, moderately steep to steep, uneroded soils on south- and west-facing slopes; low productivity potential.	Frondorf: [4] FwE3, FwE, FwF (southerly aspects).	Upland oaks Loblolly pine	55–65 65–75	90–160 440–570	Moderate to severe.	Moderate to severe.

[1] Growth estimates for oaks and yellow-poplar are for ages up to 60 years; for other species, up to 50 years. Values are average annual growth.
[2] International rule, ¼-inch kerf.

by suitability groups—Continued

Management hazards or limitations—Continued			Species suitability—			
	Plant competition		To favor in existing stands			
Seedling mortality	Coniferous	Hardwood	Desirable	Acceptable	Less desirable	For planting
Slight	Moderate	Slight	Sweetgum, yellow-poplar, white oak, northern red oak, black oak.	Scarlet oak, white ash, sugar maple, black cherry, hickory.	Buckeye, red maple, redcedar, blackgum.	Loblolly pine, white pine, shortleaf pine, black locust, white oak, red oak, white ash, yellow-poplar.
Moderate	Moderate	Slight	White oak, black oak, southern red oak.	Hickory, post oak	Sassafras, red maple	Loblolly pine, Virginia pine, shortleaf pine.
Slight	Severe	Moderate	Sweetgum, sycamore, Shumard oak, white ash.	Hickory, yellow-poplar, post oak.	Blackgum, red maple, hackberry, elm.	Loblolly pine, white ash, sycamore, sweetgum, pin oak.
Moderate	Moderate	Slight	White oak, southern red oak, black oak.	Hickory, beech	Blackgum, red maple, redcedar, elm.	Loblolly pine, shortleaf pine, Virginia pine, black locust.
Slight	Slight	Slight	White oak, black oak, scarlet oak.	Redcedar, hickory	Red maple, sugar maple, blackgum, sassafras.	Loblolly pine, shortleaf pine, redcedar, Virginia pine.
Slight to moderate.	Slight	Slight	White oak, black oak, scarlet oak.	Redcedar, hickory, post oak.	Blackgum, red maple.	Loblolly pine, shortleaf pine, Virginia pine, redcedar.

[3] The Wellston parts of FwD in group 3o1 and of FwE and FwF in group 3r1 have high productivity potential.
[4] The Wellston parts of FwD3 in group 4o1 and of FwE3, FwE, and FwF in group 4r1 have moderate productivity potential.

The ratings and other terms used in table 4 have meanings as follows:

A rating of *good* means that a suitable habitat generally is easily created or that the habitat can be improved and a suitable habitat maintained on the soil. The soil has few or no limitations to management of the habitat, and satisfactory results can be expected.

A rating of *fair* means that a suitable habitat can be created or that the habitat can be improved and maintained but that the soil has moderate limitations that affect the creation, improvement, or maintenance of the habitat. Moderately intensive management and fairly frequent attention are required for satisfactory results.

A rating of *poor* means that a suitable habitat generally can be created or that the habitat can be improved or maintained, but soil limitations art severe. Management of the habitat is difficult and expensive, and intensive effort is required. Satisfactory results are questionable.

A rating of *unsuited* means that a suitable habitat cannot be created or that the habitat cannot be improved or maintained, because of very severe soil limitations. Unsatisfactory results are probable.

Not considered in the ratings are present land use, the location of a soil in relation to other soils, and the mobility of wildlife.

Elements of habitat

Each soil is rated in table 4 according to its suitability for various kinds of plants and other elements that make up wildlife habitat. The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops.—Among these crops are such seed-producing annuals as corn, sorghum, wheat, oats, millet, buckwheat, soybeans, sunflowers, and other plants commonly grown for grain or seed. The major soil properties that affect this habitat element are effective root depth, available moisture capacity, natural drainage, slope, stones on the surface or in the surface layer, hazard of flooding, and texture of the surface layer and the subsoil.

Grasses and legumes.—Making up this group are domestic perennial grasses and herbaceous legumes that are established by planting and that provide cover and food for wildlife. Among the plants represented are bluegrass, fescue, brome, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and panicgrass. The major soil properties affecting this habitat element are effective root depth, available moisture capacity, natural drainage, slope, stones on the surface and in the surface layer, hazard of flooding, and texture of the surface layer and the subsoil.

Wild herbaceous upland plants.—In this group are native or introduced perennial grasses and weeds that generally are established naturally. Among these are bluestem, indiangrass, wheatgrass, goldenrod, wild ryegrass, oatgrass, pokeweed, wild strawberry, lespedeza, beggarweed, wild beans, nightshade, and dandelion. These plants provide food and cover, mainly to upland forms of wildlife. The major soil properties affecting this habitat element are effective root depth, available moisture capacity, natural drainage, stones on the surface and in the surface layer, hazard of flooding or ponding, and texture of the surface layer and the subsoil.

Hardwood woody plants.—These are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits and buds, catkins, twigs, or foliage that wildlife eat. They are generally established naturally, but they may be planted. Among the native kinds are oak, beech, cherry, maple, poplar, hawthorn, dogwood, persimmon, sumac, sassafras, hazelnut, black walnut, hickory, sweetgum, blueberry, viburnum, grape, and brier. The major soil properties that affect this habitat element are effective root depth, available moisture capacity, natural drainage, and stones or rocks on the surface or in the surface layer.

In this group are also several fruiting shrubs that are grown commercially for planting. Autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbrush cranberry, and silky corner dogwood are among the shrubs that can be planted on soils that have a rating of *good*. Hardwoods that are not available commercially can commonly be transplanted successfully.

Coniferous woody plants.—These are cone-bearing evergreen trees and shrubs used by wildlife primarily as cover, though they also provide browse and seeds or fruitlike cones. Among such plants are hemlock, Virginia pine, loblolly pine, shortleaf pine, pond pine, Scotch pine, and redcedar. As a rule, these plants are established naturally in areas where the cover of weeds and sod is thin, but they may also be planted. The major soil properties that affect the establishment of these plants are effective root depth, available moisture capacity, natural drainage, stones or rocks on the surface or in the surface layer, and texture of the surface layer and the subsoil. On well-suited soils, these plants grow slowly and delay closing of their canopy. It is important that plants maintain branches close to the ground so that food and cover are readily available for rabbits, pheasant, and other small animals. If the trees quickly form a dense canopy, light is reduced and the lower branches die.

On soils that are poorly suited to use for coniferous wildlife habitat, widely spaced conifers may quickly, but only temporarily, produce the desired growth. Maintaining these plants is difficult where the soils are better suited to hardwood plants. Unless the stand is carefully managed, hardwoods invade and commonly overtop the conifers.

Wetland food and cover plants.—In this group are wild herbaceous, annual, and perennial plants, exclusive of submerged or floating aquatic plants, that grow on moist to wet sites. These plants produce food and cover extensively used by wetland forms of wildlife. Smartweed, wild millet, bulrush, sedges, burreeds, rushes, rice cutgrass, mannagrass, wild rice, and cattails are among these plants. The major soil properties that affect this habitat element are natural drainage, stones on the surface or in the surface layer, frequency of flooding or ponding, slope, and texture of the surface layer and the subsoil.

Shallow water developments.—These are impoundments or excavations that provide areas of shallow water, generally not more than 5 feet deep, near food and cover for wetland wildlife. Examples of such developments are shallow dugouts, level ditches, blasted potholes,

and devices that keep the water 6 to 24 inches deep in marshes. The major soil properties that affect this habitat element are depth to bedrock, natural drainage, slope, hazard of flooding, and stones on the surface or in the surface layer.

Excavated ponds.—Excavated ponds are dug-out areas that generally receive their supply of water from a permanently high ground water table rather than from runoff. They provide water for many kinds of wildlife, especially for migratory or overwintering waterfowl. The major soil properties that affect this habitat element are depth to bedrock, natural drainage, stones on the surface or in the surface layer, slope, and hazard of flooding.

Farm ponds of the impounded type are not considered in this habitat element. These can be important for fishing and other recreational activities, however, and, in addition, they may be a source of water for wildlife. If stocked with fish, such impoundments should be at least 6 feet deep throughout a large part of the area.

Kinds of wildlife

Table 4 rates the soils according to their suitability for openland, woodland, and wetland types of wildlife. Each rating provided is based on the ratings listed for the habitat elements in the first part of the table. For openland wildlife, for example, the ratings are based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous upland plants, and hardwood woody plants. For woodland wildlife the ratings are based on the ratings shown for grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. For wetland wildlife, the ratings are based on the ratings shown for wetland food and cover plants, shallow water developments, and excavated ponds. The three kinds of wildlife shown in table 4 are described as follows.

Openland wildlife.—Included in this category are birds and mammals that normally make their homes in areas of cropland, pasture, meadow, and lawns, and in areas overgrown with grasses, herbs, and shrubs. Examples of openland wildlife are quail, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck.

Woodland wildlife.—Among the birds and mammals that prefer woodland are ruffed grouse, woodcock, thrush, vireo, scarlet tanager, gray and red squirrels, gray fox, white-tailed deer, raccoon, and wild turkey. They obtain food cover in stands of hardwoods and coniferous trees, shrubs, or a mixture of these plants.

Wetland wildlife.—Duck, geese, heron and other shore birds, mink, beaver, and muskrat are familiar examples of birds and mammals that normally make their homes in such wet areas as ponds, marshes, and swamps.

Engineering Uses of the Soils[4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 6, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by the SCS engineers, Department of Defense, and others, and the AASHO system adopted by the American Association of State Highways Officials (*2*, *15*).

[4] ROBERT H. SPENCER, JR., civil engineer, Soil Conservation Service, assisted in preparing this section.

TABLE 4.—*Suitability of soils for elements*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which may listed in the first column of this table. Soils rated *good* are well suited or above average; *fair*,

Soil series, land types, and map symbols	Wildlife habitat elements				
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Woody plants	
				Hardwoods	Coniferous
Alluvial land, steep: AlF. Variable, not rated.					
Ashton: As	Fair	Good	Good	Good	Poor
Belknap: Be	Poor	Fair	Fair	Good	Poor
Bruno: Bu	Poor	Fair	Fair	Poor	Poor
Calloway: Ca	Poor	Fair	Good	Fair	Poor
Clifty: Cg	Fair	Good	Good	Good	Poor
Collins: Co	Fair	Good	Good	Good	Poor
Elk:					
EkA	Good	Good	Good	Good	Poor
EkB, EkC	Fair	Good	Good	Good	Poor
EkE, ElC3	Poor	Fair	Good	Good	Poor
*Frondorf:					
FwD	Poor	Fair	Good	Fair	Poor
FwD3, FwE3, FwF	Unsuited	Poor	Good	Fair	Poor
FwE	Unsuited	Fair	Good	Fair	Poor
For Wellston part of FwD, FwD3, FwE, and FwE3, see Wellston series.					
Ginat: Gn	Poor	Fair	Fair	Fair	Poor
Grenada:					
GrA	Fair	Good	Good	Fair	Poor
GrB	Fair	Good	Good	Fair	Poor
Gullied land: Gu. Variable, not rated.					
Henshaw: He	Fair	Fair	Good	Good	Poor
Huntington: Hu	Fair	Good	Good	Good	Poor
Jacob: Ja	Poor	Fair	Fair	Good	Poor
Karnak: Ka, Kc	Poor	Fair	Fair	Good	Poor
Lakin: LaA	Poor	Fair	Fair	Poor	Fair
Lindside: Ld	Fair	Good	Good	Good	Poor
Loring:					
LoA, LoB, LoC	Fair	Good	Good	Good	Poor
LoD, LrC3	Poor	Fair	Good	Fair	Poor
LrD3	Unsuited	Poor	Good	Fair	Poor
McGary: Mc	Fair	Fair	Fair	Good	Poor
Markland:					
MdA, MeB2	Fair	Fair	Fair	Good	Poor
MfC3	Poor	Fair	Fair	Fair	Poor
MdE	Poor	Fair	Fair	Good	Poor
MfE3	Unsuited	Poor	Fair	Fair	Poor
Melvin: Mh	Poor	Fair	Fair	Good	Poor
Memphis:					
MmA	Good	Good	Good	Good	Poor
MmB, MmC	Fair	Good	Good	Good	Poor
MmE, MnC3	Poor	Fair	Good	Good	Poor
MmF, MnE3	Unsuited	Poor	Good	Good	Poor
Montgomery: Mo	Unsuited	Poor	Poor	Good	Poor
Newark: Ne	Poor	Fair	Fair	Good	Poor
Otwell:					
OtA	Fair	Good	Good	Fair	Poor
OtB	Fair	Good	Good	Fair	Poor
Patton: Pa, Ph	Poor	Fair	Fair	Good	Poor
Sciotoville: ScA	Fair	Good	Good	Fair	Poor
Shelocta:					
ShC	Fair	Good	Good	Good	Poor
ShD	Poor	Fair	Good	Good	Poor
Strip mine spoil: St. Variable, not rated.					
Uniontown:					
UnA	Good	Good	Good	Good	Poor
UnB	Fair	Good	Good	Good	Poor
UoC3	Poor	Fair	Good	Good	Poor

of wildlife habitat and kinds of wildlife

have different suitabilities for wildlife. For this reason the reader should follow carefully the instructions for referring to another series suited or average; *poor*, poorly suited or below average; and *unsuited*, use not feasible]

Wildlife habitat elements—Continued			Kinds of wildlife		
Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Fair	Fair	Unsuited	Fair	Fair	Fair.
Unsuited	Unsuited	Unsuited	Fair	Poor	Unsuited.
Poor	Fair	Fair	Fair	Fair	Fair.
Unsuited	Unsuited	Unsuited	Good	Fair	Unsuited.
Poor	Poor	Poor	Good	Good	Poor.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Poor	Poor	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Poor	Good	Good	Fair	Poor	Fair.
Poor	Poor	Poor	Good	Fair	Poor.
Poor	Unsuited	Unsuited	Good	Fair	Unsuited.
Fair	Fair	Fair	Good	Fair	Fair.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Fair	Fair	Unsuited	Fair	Fair	Fair.
Poor	Good	Poor	Fair	Fair	Fair.
Unsuited	Unsuited	Unsuited	Fair	Poor	Unsuited.
Poor	Poor	Poor	Good	Good	Poor.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Poor	Fair	Unsuited.
Poor	Fair	Fair	Fair	Fair	Fair.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Poor	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Poor	Poor	Unsuited.
Fair	Fair	Unsuited	Fair	Fair	Fair.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Poor	Fair	Unsuited.
Poor	Fair	Unsuited	Poor	Fair	Poor.
Fair	Fair	Unsuited	Fair	Fair	Fair.
Poor	Poor	Poor	Good	Fair	Poor.
Poor	Unsuited	Unsuited	Good	Fair	Unsuited.
Poor	Fair	Unsuited	Fair	Fair	Poor.
Poor	Poor	Poor	Good	Fair	Poor.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.

TABLE 4.—*Suitability of soils for elements*

Soil series, land types, and map symbols	Wildlife habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Woody plants: Hardwoods	Woody plants: Coniferous
Urban land: Ur Variable, not rated.					
Wakeland: Wa	Poor	Fair	Fair	Good	Poor
Waverly: We	Poor	Fair	Fair	Good	Poor
Weinbach: Wh	Fair	Fair	Good	Fair	Poor
Wellston:					
WIC	Fair	Good	Good	Good	Poor
WIC3, WID	Poor	Fair	Good	Good	Poor
WIE	Unsuited	Fair	Good	Good	Poor
WIE3	Unsuited	Poor	Good	Good	Poor
Wheeling:					
WnA	Good	Good	Good	Good	Poor
WnB, WnC	Fair	Good	Good	Good	Poor
Wilbur: Wu	Fair	Good	Good	Good	Poor
Zanesville:					
ZaB, ZaC	Fair	Good	Good	Good	Poor
ZaC3	Poor	Fair	Good	Fair	Poor

TABLE 5.—*Estimated soils properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which may of this table. The

Soil series, land types, and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface of typical profile	Classification: USDA texture	Unified	AASHO
Alluvial land, steep: AIF. Too variable for valid estimates.	*Ft.*	*Ft.*	*In.*			
Ashton:[1] As	>50	>3	0–7	Silt loam	ML or ML–CL	A-6 or A-4
			7–54	Silty clay loam	ML–CL	A-7 or A-6
			54–60	Heavy silty clay loam	CL or ML–CL	A-7
Belknap:[1] Be	>7	½–1½	0–50	Silt loam	ML	A-4
Bruno:[1] Bu	>50	>6	0–15	Loamy fine sand	SM	A-2 or A-4
			15–18	Fine sandy loam	SM or ML	A-4
			18–50	Loamy fine sand	SM	A-2 or A-4
Calloway: Ca	>4	½–1½	0–27	Silt loam	ML	A-4
			27–50	Heavy silt loam (fragipan)	ML or CL	A-4
Clifty:[1] Cg	>4	>4	0–8	Gravelly loam	SM or GM	A-4
			8–38	Gravelly silt loam	SM or GM	A-4
			38–50	Gravelly silt loam	SM or GM	A-4
Collins:[1] Co	>10	1½–3	0–60	Silt loam	ML	A-4
Elk: EkA, EkB, EkC, EkE, EIC3.	>50	>6	0–8	Silt loam	ML–CL	A-4
			8–36	Light silty clay loam	ML–CL	A-4 or A-6
			36–50	Loam	ML	A-4

See footnote at end of table.

of wildlife habitat and kinds of wildlife—Continued

Wildlife habitat elements—Continued			Kinds of wildlife		
Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Fair	Fair	Unsuited	Fair	Fair	Fair.
Fair	Fair	Unsuited	Fair	Fair	Fair.
Fair	Fair	Fair	Good	Fair	Fair.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Poor	Fair	Unsuited.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Poor	Poor	Poor	Good	Good	Poor.
Unsuited	Unsuited	Unsuited	Good	Good	Unsuited.
Unsuited	Unsuited	Unsuited	Fair	Fair	Unsuited.

significant to engineering

have different properties. For this reason the reader should carefully follow the instructions for referring to another series in the first column symbol > means greater than]

Material 3 inches or less in diameter passing sieve—				Permeability	Available moisture capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
Pct.	*Pct.*	*Pct.*	*Pct.*	*In. per hr.*	*In. per in. of soil*	*pH*	
100	95–100	90–100	80–95	0. 63–2. 0	0. 18–0. 20	7. 3–7. 8	Low.
100	95–100	95–100	85–95	0. 63–2. 0	0. 16–0. 18	5. 5–7. 3	Low to moderate.
100	95–100	95–100	90–95	0. 63–2. 0	0. 15–0. 17	5. 5–6. 5	Moderate.
100	95–100	95–100	80–100	0. 63–2. 0	0. 18–0. 20	4. 5–5. 5	Low.
100	85–100	70–85	25–45	6. 3–20. 0	0. 06–0. 08	5. 0–7. 3	Very low.
100	85–100	70–85	40–55	6. 3–20. 0	0. 08–0. 14	5. 0–7. 3	Very low.
100	85–100	70–85	25–45	6. 3–20. 0	0. 06–0. 08	5. 0–7. 3	Very low.
100	95–100	90–100	75–95	0. 63–2. 0	0. 18–0. 20	5. 5–6. 0	Low.
100	95–100	80–95	70–90	0. 06–0. 20	0. 10–0. 12	5. 0–6. 5	Low.
65–75	55–70	50–55	35–40	0. 63–2. 0	0. 09–0. 11	4. 5–5. 5	Low to very low.
70–80	60–70	50–60	35–45	2. 0–6. 3	0. 13–0. 15	4. 5–5. 5	Low to very low.
60–70	55–70	50–60	35–45	2. 0–6. 3	0. 13–0. 15	4. 5–5. 5	Low to very low.
100	95–100	90–100	70–90	0. 63–2. 0	0. 18–0. 20	4. 5–5. 5	Low.
100	95–100	90–100	70–90	0. 63–2. 0	0. 18–0. 20	5. 6–6. 0	Low.
100	95–100	95–100	85–95	0. 63–2. 0	0. 16–0. 18	4. 5–5. 0	Low to moderate.
100	95–100	85–95	60–75	2. 0–6. 3	0. 14–0. 16	5. 1–5. 5	Low.

TABLE 5.—*Estimated soils properties*

Soil series, land types, and map symbols	Depth to—		Depth from surface of typical profile	Classification		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
*Frondorf: FwD, FwD3, FwE, FwE3, FwF. For Wellston part, see Wellston series.	1½-3½	>6	0-7	Silt loam	ML	A-4
			7-18	Silty clay loam	CL or ML-CL	A-4 or A-6
			18-30	Gravelly silty clay loam	SM or GM	A-4
			30	Bedrock.		
Ginat: Gn	>50	0-½	0-20	Silt loam	ML or CL-ML	A-4 or A-6
			20-26	Heavy silt loam (fragipan)	ML or ML-CL	A-4 or A-6
			26-40	Silty clay loam (fragipan)	CL or ML-CL	A-4 or A-6
			40-52	Silty clay loam	ML-CL	A-6
Grenada: GrA, GrB	>6	1½-2½	0-7	Silt loam	ML	A-4
			7-22	Heavy silt loam	ML-CL	A-4 or A-6
			22-36	Silt loam (fragipan)	ML-CL	A-4 or A-6
			36-50	Silty clay loam	ML-CL	A-4 or A-6
Gullied land: Gu. Too variable for valid estimates.						
Henshaw: He	>20	1-2	0-9	Silt loam	ML or ML-CL	A-4
			9-45	Silty clay loam	CL or ML-CL	A-4 or A-6
			45-60	Silt loam	ML or ML-CL	A-4 or A-6
Huntington:[1] Hu	>50	>3	0-60	Silt loam	ML-CL	A-4 or A-6
Jacob:[1] Ja	>50	0-½	0-7	Silty clay loam	ML-CL	A-6 or A-7
			7-50	Silty clay	CL or CH	A-7
Karnak:[1] Ka, Kc	>20	0-½	0-10	Silty clay	CL or CH	A-7
			10-50	Clay	CH	A-7
Lakin: LaA	>50	>6	0-7	Loamy fine sand	SM	A-2 or A-4
			7-30	Loamy fine sand	SM	A-2 or A-4
			30-50	Sand	SM or SP-SM	A-2 or A-3
Lindside:[1] Ld	>20	1½-3	0-50	Silt loam	ML-CL	A-4 or A-6
Loring: LoA, LoB, LoC, LoD, LrC3, LrD3.	6-12	2-6	0-7	Silt loam	ML	A-4
			7-30	Light silty clay loam	ML-CL	A-4 or A-6
			30-54	Silt loam (fragipan)	ML-CL	A-4 or A-6
			54-60	Silt loam	ML	A-4
McGary: Mc	>10	½-1	0-7	Silt loam	ML	A-4
			7-15	Silty clay loam	ML-CL	A-6 or A-7
			15-36	Silty clay	CL or CH	A-7
			36-50	Clay	CL or CH	A-7
Markland: MdA, MdE, MeB2, MfC3, MfE3.	>6	3-6	0-9	Silt loam	ML or ML-CL	A-4 or A-6
			9-50	Clay	CL or CH	A-7
Melvin:[1] Mh	>50	0-½	0-50	Silt loam	ML-CL	A-6
Memphis: MmA, MmB, MmC, MmE, MmF, MnC3, MnE3.	>6	>6	0-9	Silt loam	ML	A-4
			9-34	Light silty clay loam	ML or ML-CL	A-4 or A-6
			34-60	Silt loam	ML	A-4
Montgomery:[1] Mo	>30	0-½	0-8	Silty clay loam	CL or ML-CL	A-7
			8-42	Silty clay	CL or CH	A-7
			42-52	Clay	CL or CH	A-7
Newark:[1] Ne	>20	½-1½	0-9	Silt loam	ML-CL	A-4 or A-6
			9-32	Silt loam	ML-CL	A-4 or A-6
			32-60	Silt loam	ML-CL	A-4 or A-6

See footnote at end of table.

significant to engineering—Continued

Material 3 inches or less in diameter passing sieve—				Permeability	Available moisture capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
Pct.	*Pct.*	*Pct.*	*Pct.*	*In. per hr.*	*In. per in. of soil*	*pH*	
100	85–90	75–90	70–80	0. 63–2. 0	0. 17–0. 19	4. 5–6. 0	Low.
100	75–90	70–80	65–75	0. 63–2. 0	0. 11–0. 13	4. 5–6. 0	Low to moderate.
65–75	60–70	50–60	40–50	0. 63–2. 0	0. 09–0. 11	4. 5–6. 0	Low.
100	95–100	90–100	80–95	0. 63–2. 0	0. 17–0. 19	4. 5–6. 0	Low.
100	100	90–100	80–95	0. 06–0. 20	0. 13–0. 15	4. 5–6. 0	Low.
100	100	90–100	80–95	0. 06–0. 20	0. 13–0. 15	4. 5–6. 0	Low to moderate.
100	100	90–100	80–95	0. 20–2. 0	0. 13–0. 15	4. 5–6. 0	Low to moderate.
100	90–100	85–100	75–95	0. 63–2. 0	0. 19–0. 21	5. 6–6. 0	Low.
100	90–100	90–100	85–95	0. 63–2. 0	0. 15–0. 17	5. 1–6. 0	Low.
100	90–100	90–100	75–90	0. 06–0. 20	0. 10–0. 12	5. 1–6. 0	Low.
100	90–100	85–100	80–95	0. 20–2. 0	0. 10–0. 12	5. 1–6. 5	Low.
100	95–100	90–100	75–95	0. 63–2. 0	0. 18–0. 20	6. 1–6. 5	Low.
100	95–100	90–100	85–95	0. 20–0. 63	0. 16–0. 18	5. 0–6. 5	Low to moderate.
100	90–100	85–95	75–90	0. 20–2. 0	0. 17–0. 19	6. 1–7. 8	Low.
100	90–100	80–95	70–90	0. 63–2. 0	0. 19–0. 21	6–1–7. 8	Low.
100	90–100	90–100	80–95	0. 20–0. 63	0. 15–0. 17	4. 5–5. 5	Low to moderate.
100	95–100	90–100	85–95	0. 20–0. 63	0. 12–0. 14	4. 5–5. 5	Moderate to high.
100	90–100	90–100	80–100	0. 06–0. 20	0. 13–0. 15	5. 6–6. 0	High.
100	90–100	90–100	80–100	0. 06–0. 20	0. 12–0. 14	5. 6–7. 8	Very high.
100	90–100	70–85	25–45	6. 30–20. 0	0. 06–0. 08	5. 1–5. 5	Very low.
100	90–100	70–85	25–45	6. 30–20. 0	0. 06–0. 08	4. 5–5. 5	Very low.
100	90–100	55–75	5–25	6. 30–20. 0	0. 03–0. 05	4. 5–5. 5	Very low.
100	90–100	85–95	75–90	0. 63–2. 0	0. 19–0. 21	5. 6–6. 5	Low.
100	85–100	85–100	75–95	0. 63–2. 0	0. 18–0. 20	5. 6–6. 0	Low.
100	90–100	90–100	85–95	0. 63–2. 0	0. 15–0. 17	5. 1–6. 0	Low to moderate.
100	90–100	90–100	75–95	0. 06–0. 20	0. 12–0. 14	5. 1–5. 5	Low.
100	90–100	85–100	75–95	0. 63–2. 0	0. 12–0. 14	5. 1–6. 5	Low.
100	90–100	85–100	75–95	0. 63–2. 0	0. 17–0. 19	5. 1–5. 5	Low.
100	90–100	85–100	75–95	0. 20–0. 63	0. 15–0. 17	5. 6–6. 0	Low to moderate.
100	90–100	85–100	80–95	0. 06–0. 20	0. 12–0. 14	5. 1–5. 5	Moderate to high.
100	90–100	85–100	75–95	0. 06–0. 20	0. 12–0. 14	6. 6–7. 8	High.
100	95–100	90–100	75–95	0. 63–2. 0	0. 17–0. 19	5. 6–6. 0	Low.
100	95–100	90–100	75–95	0. 06–0. 20	0. 11–0. 13	5. 1–8. 4	High.
100	90–100	85–95	75–90	0. 63–2. 0	0. 19–0. 21	6. 1–6. 5	Low.
100	100	95–100	90–100	0. 63–2. 0	0. 18–0. 20	5. 1–5. 5	Low.
100	100	100	90–100	0. 63–2. 0	0. 16–0. 18	4. 5–6. 0	Low.
100	100	100	90–100	0. 63–2. 0	0. 18–0. 20	5. 1–6. 5	Low.
100	95–100	90–100	85–95	0. 20–0. 63	0. 16–0. 18	6. 1–6. 5	Moderate.
100	95–100	90–100	85–95	0. 06–0. 20	0. 13–0. 15	6. 1–7. 8	High.
100	95–100	90–100	85–95	0. 06–0. 20	0. 12–0. 14	7. 9–8. 4	High.
100	90–100	85–95	75–90	0. 63–2. 0	0. 19–0. 21	5. 6–6. 0	Low.
100	90–100	85–95	75–95	0. 63–2. 0	0. 18–0. 20	5. 6–7. 3	Low.
100	90–100	85–95	75–90	0. 63–2. 0	0. 19–0. 21	5. 6–7. 8	Low.

TABLE 5.—*Estimated soils properties*

Soil series, land types, and map symbols	Depth to—		Depth from surface of typical profile	Classification		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Otwell: OtA, OtB	>50	1½–2½	0–7	Silt loam	ML	A–4
			7–26	Silt loam	CL–ML	A–4 or A–6
			26–40	Heavy silt loam (fragipan)	ML–CL	A–4 or A–6
			40–60	Heavy silt loam	CL–ML	A–4 or A–6
Patton:[1] Pa, Ph	>20	0–½	0–7	Silt loam	ML or ML–CL	A–7 or A–6
			7–32	Heavy silt loam	CL or ML–CL	A–6 or A–7
			32–50	Silty clay loam	CL or ML–CL	A–6 or A–7
Sciotoville: ScA	>50	1½–2½	0–7	Loam	ML or ML–CL	A–4
			7–27	Loam	ML–CL	A–4
			27–52	Loam (fragipan)	ML–CL	A–4
			52–60	Loam	ML or ML–CL	A–4
Shelocta: ShC, ShD	4–10	>6	0–7	Silt loam	ML	A–4
			7–34	Gravelly light silty clay loam	GM	A–4
			34–50	Gravelly silty clay loam	GM or ML	A–4
Strip mine spoil: St. Too variable for valid estimates.						
Uniontown: UnA, UnB, UoC3.	>10	3–6	0–9	Silt loam	ML	A–4
			9–34	Light silty clay loam or heavy silt loam.	CL or ML–CL	A–4 or A–6
			34–65	Silt loam	ML or ML–CL	A–4 or A–6
Urban land: Ur. Not estimated.						
Wakeland:[1] Wa	>8	½–1½	0–60	Silt loam	ML	A–4
Waverly:[1] We	>6	0–½	0–50	Silt loam	ML	A–4
Weinbach: Wh	>50	½–1½	0–8	Silt loam	ML	A–4
			8–24	Heavy silt loam	ML–CL	A–6
			24–40	Silt loam (fragipan)	ML	A–4 or A–6
			40–50	Silty clay loam	ML–CL	A–4 or A–6
Wellston: WlC, WlC3, WlD, WlE, WlE3.	3–6	>6	0–5	Heavy silt loam	ML	A–4 or A–6
			5–26	Light silty clay loam	CL or ML–CL	A–4 or A–6
			26–40	Heavy silt loam	ML or ML–CL	A–4 or A–6
			40–60	Fine sandy loam	ML or SM	A–4
			60	Bedrock.		
Wheeling: WnA, WnB, WnC.	>50	>6	0–7	Loam	ML	A–4
			7–12	Light clay loam	ML–CL	A–4 or A–6
			12–25	Heavy loam	ML	A–4
			25–50	Fine sandy loam	SM or ML	A–4
Wilbur:[1] Wu	>10	1½–3	0–50	Silt loam	ML	A–4
Zanesville: ZaB, ZaC, ZaC3.	4–6	2–2½	0–8	Silt loam	ML	A–4
			8–26	Heavy silt loam	CL or ML–CL	A–4 or A–6
			26–60	Silt loam (fragipan)	ML or CL	A–4 or A–6
			60	Bedrock.		

[1] Subject to flooding.

significant to engineering—Continued

Material 3 inches or less in diameter passing sieve—				Permeability	Available moisture capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
Pct.	*Pct.*	*Pct.*	*Pct.*	*In. per hr.*	*In. per in. of soil*	*pH*	
100	85–95	80–90	75–90	0. 63–2. 0	0. 18–0. 20	5. 6–6. 0	Low.
100	85–100	80–100	75–90	0. 63–2. 0	0. 17–0. 19	4. 5–5. 0	Low.
100	90–100	90–100	75–90	0. 06–0. 20	0. 10–0. 12	4. 5–5. 0	Low.
100	95–100	95–100	90–100	0. 63–2. 0	0. 10–0. 12	5. 1–5. 5	Low.
100	95–100	95–100	90–100	0. 63–2. 0	0. 18–0. 20	6. 6–7. 3	Low.
100	95–100	95–100	90–100	0. 63–2. 0	0. 17–0. 19	6. 1–7. 3	Low.
100	95–100	95–100	90–100	0. 63–2. 0	0. 16–0. 18	6. 1–7. 8	Low to moderate.
100	90–100	85–95	50–75	0. 63–2. 0	0. 13–0. 15	6. 1–6. 5	Low.
100	90–100	85–95	60–80	0. 63–2. 0	0. 13–0. 15	4. 5–5. 0	Low.
100	90–100	85–95	60–80	0. 06–0. 20	0. 10–0. 12	4. 5–5. 0	Low.
100	90–100	85–95	60–80	2. 0–6. 3	0. 10–0. 12	4. 5–5. 0	Low.
90–100	85–95	80–90	70–90	0. 63–2. 0	0. 18–0. 20	5. 6–6. 0	Low.
65–75	60–70	50–60	35–50	0. 63–2. 0	0. 11–0. 13	4. 5–5. 5	Low.
60–75	55–70	40–60	35–55	0. 63–6. 3	0. 09–0. 11	5. 1–5. 5	Low.
100	95–100	90–100	80–95	0. 63–2. 0	0. 18–0. 20	6. 6–7. 3	Low.
100	95–100	95–100	85–95	0. 63–2. 0	0. 16–0. 18	5. 1–7. 3	Low to moderate.
100	95–100	95–100	85–95	0. 63–2. 0	0. 18–0. 20	6. 6–8. 4	Low.
100	95–100	95–100	80–95	0. 63–2. 0	0. 18–0. 20	5. 6–7. 8	Low.
100	95–100	95–100	80–95	0. 63–2. 0	0. 18–0. 20	4. 5–5. 5	Low.
100	95–100	90–100	75–90	0. 63–2. 0	0. 18–0. 20	5. 6–6. 0	Low.
100	95–100	90–100	75–90	0. 63–2. 0	0. 17–0. 19	4. 5–5. 5	Low.
100	95–100	80–95	70–90	0. 06–0. 2	0. 10–0. 12	4. 5–5. 0	Low.
100	95–100	95–100	85–95	0. 63–2. 0	0. 10–0. 12	5. 1–5. 5	Low to moderate.
100	95–100	90–100	75–90	0. 63–2. 0	0. 17–0. 19	5. 6–6. 0	Low.
100	95–100	95–100	85–95	0. 63–2. 0	0. 17–0. 19	5. 1–5. 5	Low.
100	95–100	90–100	75–90	0. 63–2. 0	0. 17–0. 19	4. 5–5. 0	Low.
100	90–100	70–85	40–55	2. 0–6. 3	0. 10–0. 12	4. 5–5. 0	Very low.
100	90–100	85–100	50–75	0. 63–2. 0	0. 14–0. 16	5. 1–6. 0	Low.
100	90–100	85–100	50–80	0. 63–2. 0	0. 14–0. 16	5. 1–6. 0	Low.
100	90–100	85–100	50–75	0. 63–2. 0	0. 14–0. 16	5. 1–6. 0	Low.
100	90–100	70–85	40–55	2. 0–6. 3	0. 12–0. 14	5. 1–6. 0	Low.
100	95–100	95–100	80–95	0. 63–2. 0	0. 18–0. 20	5. 6–7. 3	Low.
100	95–100	90–100	70–90	0. 63–2. 0	0. 18–0. 20	4. 5–5. 5	Low.
100	95–100	90–100	75–90	0. 63–2. 0	0. 17–0. 19	4. 5–5. 5	Low.
100	90–100	90–100	70–90	0. 06–0. 20	0. 11–0. 13	4. 5–5. 5	Low.

TABLE 6.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit is made up of two or more kinds of soil, which may have different column of

Soil series, land types, and map symbols	Suitability as a source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Construction of farm ponds: Reservoir area	Construction of farm ponds: Embankment
Alluvial land, steep: AlF. Too variable for valid interpretations.					
Ashton: As	Good in upper 7 inches; fair below 7 inches; moderately fine texture.	Poor: A-6 or A-7 material.	Subject to flooding	Features generally favorable.	Fair stability; fair compaction.
Belknap: Be	Fair: seasonal water table at depth of ½ to 1½ feet.	Fair: seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; medium compressibility; possible liquefaction; subject to flooding.	Seasonal water table at depth of ½ to 1½ feet; moderate permeability.	Poor stability; poor compaction; moderate permeability; highly dispersible; medium compressibility.
Bruno: Bu	Poor: sandy; low available moisture capacity.	Fair: A-2 or A-4 material.	Subject to flooding; highly erodible.	Rapid permeability	Rapid permeability; susceptible to piping.
Calloway: Ca	Fair: seasonal water table at depth of ½ to 1½ feet.	Fair: A-4 material; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet.	Poor stability; poor compaction; susceptible to piping.
Clifty: Cg	Poor: 20 to 25 percent gravel.	Fair: A-4 material	Subject to flooding	Moderately rapid permeability.	Moderately rapid permeability; susceptible to piping.
Collins: Co	Fair: seasonal water table at depth of 1½ to 3 feet.	Fair: A-4 material; seasonal water table at depth of 1½ to 3 feet.	Seasonal water table at depth of 1½ to 3 feet; medium compressibility; possible liquefaction; subject to flooding.	Moderate permeability.	Poor stability; poor compaction; moderate permeability; highly dispersible; medium compressibility.
Elk: EkA, EkB, EkC, EkE, ElC3.	Good in upper 8 inches; fair below 8 inches; moderately fine texture; slope.	Fair: A-4 or A-6 material; slope.	Some steep slopes	Moderate permeability; pervious substratum; slope.	Fair stability; fair compaction; medium compressibility.
*Frondorf: FwD, FwD3, FwE, FwE3, FwF. For Wellston part, see Wellston series.	Poor: slope	Poor: steep slopes; bedrock at depth of 1½ to 3½ feet.	Steep slopes; bedrock at depth of 1½ to 3½ feet.	Steep slopes; moderate permeability; pervious bedrock at depth of 1½ to 3½ feet.	Bedrock at depth of 1½ to 3½ feet; subject to piping.
Ginat: Gn	Poor: seasonal water table at depth of 0 to ½ foot.	Poor: A-4 or A-6 material; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Fair stability; medium compressibility; subject to piping.

engineering properties of the soils

engineering interpretations. For this reason the reader should follow carefully the instructions for referring to another series in the first this table]

Soil features affecting—Continued				
Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Foundations for buildings
Well drained	Subject to flooding	Subject to flooding; nearly level.	Features generally favorable.	Subject to flooding.
Seasonal water table at depth of ½ to 1½ feet; subject to flooding; few outlets.	Seasonal water table at depth of ½ to 1½ feet; subject to flooding.	Seasonal water table at depth of ½ to 1½ feet; subject to flooding; nearly level.	Seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; subject to flooding; medium compressibility.
Excessively drained	Subject to flooding; low natural fertility; rapid intake rate.	Subject to flooding; low natural fertility; sandy; low runoff; nearly level.	Highly erodible; low available moisture capacity; low natural fertility.	Subject to flooding; sandy; poor stability.
Slow permeability; few outlets; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; slowly permeable fragipan at depth of 27 inches.	Seasonal water table at depth of ½ to 1½ feet; nearly level.	Fragipan at depth of 27 inches; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet.
Well drained	Subject to flooding	Subject to flooding; nearly level.	Features generally favorable.	Subject to flooding.
Seasonal water table at depth of 1½ to 3 feet; few outlets; subject to flooding.	Subject to flooding	Subject to flooding; nearly level.	Features generally favorable.	Seasonal water table at depth of 1½ to 3 feet; subject to flooding; medium compressibility.
Well drained	Erodible on steep slopes	Some short steep slopes	Erodible on steep slopes.	Medium compressibility; fair stability.
Well drained	Steep slopes; bedrock at depth of 1½ to 3½ feet.	Steep slopes; bedrock at depth of 1½ to 3½ feet.	Steep slopes; bedrock at depth of 1½ to 3½ feet.	Bedrock at depth of 1½ to 3½ feet.
Slowly permeable fragipan at depth of 20 inches; seasonal water table at depth of 0 to ½ foot; few outlets.	Slowly permeable fragipan at depth of 20 inches; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; slope.	Seasonal water table at depth of 0 to ½ foot; fragipan at depth of 20 inches; slope.	Seasonal water table at depth of 0 to ½ foot.

TABLE 6.—*Interpretations of*

Soil, series, land types, and map symbols	Suitability as a source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Construction of farm ponds	
				Reservoir area	Embankment
Grenada: GrA, GrB.	Good	Fair: A-4 or A-6 material.	Seasonal water table at depth of 1½ to 2½ feet.	Features generally favorable.	Fair stability; fair compaction; medium to high compressibility.
Gullied land: Gu. Too variable for valid interpretations.					
Henshaw: He	Fair: seasonal water table at depth of 1 to 2 feet.	Poor: A-4 or A-6 material; seasonal water table at depth of 1 to 2 feet.	Seasonal water table at depth of 1 to 2 feet; fair to poor compaction.	Seasonal water table at depth of 1 to 2 feet; moderate seepage rate in substratum.	Fair stability; fair compaction; medium compressibility.
Huntington: Hu	Good	Fair: A-4 or A-6 material.	Subject to flooding	Moderate permeability.	Fair stability; fair compaction; medium compressibility.
Jacob: Ja	Poor: seasonal water table at depth of 0 to ½ foot; clayey below depth of 7 inches.	Poor: A-6 or A-7 material; seasonal water table at depth of 0 to ½ foot; moderate to high shrink-swell potential.	Subject to flooding; moderate to high shrink-swell potential; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Fair stability; fair compaction; medium to high compressibility; moderate to high shrink-swell potential.
Karnak: Ka, Kc	Poor: clayey; seasonal water table at depth of 0 to ½ foot.	Poor: A-7 material; seasonal water table at depth of 0 to ½ foot; very high shrink-swell potential.	Subject to flooding; very high shrink-swell potential; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; flat relief.	Fair to poor stability; fair to poor compaction; high compressibility; very high shrink-swell potential.
Lakin: LaA	Poor: sandy; low available moisture capacity.	Fair: A-2 or A-4 material.	Highly erodible	Rapid permeability	Susceptible to piping; fair stability; moderately low fertility.
Lindside: Ld	Fair: seasonal water table at depth of 1½ to 3 feet.	Fair: A-4 or A-6 material; seasonal water table at depth of 1½ to 3 feet.	Subject to flooding; seasonal water table at depth of 1½ to 3 feet.	Moderate permeability.	Fair stability; fair compaction; medium compressibility.
Loring: LoA, LoB, LoC, LoD, LrC3, LrD3.	Good except where slopes are more than 12 percent.	Fair: A-4 or A-6 material; slope.	Slope; seasonal water table at depth of 2 to 6 feet.	Some slopes more than 12 percent.	Fair stability; fair compaction; medium to high compressibility.
McGary: Mc	Poor: clayey; seasonal water table at depth of ½ to 1 foot.	Poor: A-7 material; highly plastic; moderate to high shrink-swell potential.	Seasonal water table at depth of ½ to 1 foot; high to moderate shrink-swell potential.	Seasonal water table at depth of ½ to 1 foot.	Fair stability; fair compaction; high compressibility; moderate to high shrink-swell potential; seasonal water table at depth of ½ to 1 foot.

engineering properties of the soils—Continued

Soil features affecting—Continued				
Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Foundations for buildings
Fragipan at depth of 22 inches; seasonal water table at depth of 1½ to 2½ feet.	Fragipan at depth of 20 inches.	Fragipan at depth of 22 inches.	Fragipan at depth of 22 inches.	Fair stability; medium to high compressibility; seasonal water table at depth of 1½ to 2½ feet.
Seasonal water table at depth of 1 to 2 feet; few outlets; moderately slow permeability.	Seasonal water table at depth of 1 to 2 feet.	Seasonal water table at depth of 1 to 2 feet.	Seasonal water table at depth of 1 to 2 feet.	Seasonal water table at depth of 1 to 2 feet; poor to fair stability; medium compressibility.
Well drained	Subject to flooding	Subject to flooding	Features generally favorable.	Subject to flooding.
Moderately slow permeability; seasonal water table at depth of 0 to ½ foot; few outlets; subject to flooding.	Subject to flooding; seasonal water table at depth of 0 to ½ foot; moderately slow permeability.	Subject to flooding; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; subject to flooding; moderate to high shrink-swell potential; high compressibility.
Subject to flooding; seasonal water table at depth of 0 to ½ foot; slow permeability; few outlets.	Subject to flooding; seasonal water table at depth of 0 to ½ foot; slow intake rate.	Subject to flooding; seasonal water table at depth of 0 to ½ foot; dense and clayey.	Dense and clayey; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; very high shrink-swell potential; high compressibility; subject to flooding.
Excessively drained	Rapid intake rate; low available moisture capacity; moderately low fertility.	Sandy; moderately low fertility; low runoff.	Highly erodible; moderately low fertility; low available moisture capacity.	Poor stability; sandy.
Seasonal water table at depth of 1½ to 3 feet; subject to flooding.	Subject to flooding	Subject to flooding	Features generally favorable.	Subject to flooding; seasonal water table at depth of 1½ to 3 feet.
Moderately well drained.	Fragipan at depth of 30 inches; slope.	Fragipan at depth of 30 inches; slope.	Fragipan at depth of 30 inches; erodible on steep slopes.	Seasonal water table at depth of 2 to 6 feet; medium to high compressibility.
Slow permeability; few outlets in some areas.	Seasonal water table at depth of ½ to 1 foot; slow permeability.	Seasonal water table at depth of ½ to 1 foot; clayey subsoil.	Seasonal water table at depth of ½ to 1 foot; clayey subsoil.	Moderate to high shrink-swell potential; high compressibility; seasonal water table at depth of ½ to 1 foot.

TABLE 6.—*Interpretations of*

Soil series, land types, and map symbols	Suitability as a source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Construction of farm ponds	
				Reservoir area	Embankment
Markland: MdA, MdE, MeB2, MfC3, MfE3.	Good in upper 9 inches; poor below 9 inches; clayey; slope.	Poor: A–6 or A–7 material; highly plastic; high shrink-swell potential; slope.	High shrink-swell potential; slope; high compressibility; fair to poor stability.	Features generally favorable.	Fair to poor stability; fair to poor compaction; high compressibility; high shrink-swell potential.
Melvin: Mh	Poor: seasonal water table at depth of 0 to ½ foot.	Poor: A–6 material; seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; moderate permeability.	Fair stability; fair compaction; high compressibility.
Memphis: MmA, MmB, MmC, MmE, MmF, MnC3, MnE3.	Good except where slopes are more than 12 percent.	Fair: A–4 or A–6 material; highly erodible on slopes.	Highly erodible on slopes.	Moderate permeability; some steep slopes.	Poor stability; poor compaction; medium compressibility.
Montgomery: Mo	Poor: clayey; seasonal water table at depth of 0 to ½ foot.	Poor: A–7 material; seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot; high shrink-swell potential; high compressibility.	Seasonal water table at depth of 0 to ½ foot.	Poor stability; poor compaction; high compressibility; high shrink-swell potential.
Newark: Ne	Fair: seasonal water table at depth of ½ to 1½ feet.	Fair: A–4 or A–6 material; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; subject to flooding.	Seasonal water table at depth of ½ to 1½ feet; moderate permeability.	Fair stability; fair compaction; medium compressibility; subject to piping.
Otwell: OtA, OtB	Good	Fair: A–4 or A–6 material; seasonal water table at depth of 1½ to 2½ feet.	Seasonal water table at depth of 1½ to 2½ feet; medium compressibility.	Moderate permeability below depth of 40 inches.	Fair stability; fair compaction; medium compressibility.
Patton: Pa, Ph	Poor: seasonal water table at depth of 0 to ½ foot.	Poor: A–6 or A–7 material; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; subject to flooding.	Seasonal water table at depth of 0 to ½ foot; moderate permeability.	Fair stability; fair compaction; medium to high compressiblity.
Sciotoville: ScA	Good	Fair: A–4 material.	Seasonal water table at depth of 1½ to 2½ feet.	Moderately rapid permeability in substratum.	Subject to piping; moderate permeability.
Shelocta: ShC, ShD.	Good in upper 7 inches; fair below 7 inches.	Fair: A–4 material; slope.	Some steep slopes	Pervious substratum; slope.	Subject to piping
Strip mine spoil: St. Too variable for valid interpretations.					

engineering properties of the soils—Continued

Soil features affecting—Continued				
Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Foundations for buildings
Well drained or moderately well drained.	Slow permeability; slope.	Slope; clayey subsoil	Slope; clayey subsoil	High shrink-swell potential; high compressibility; fair to poor stability.
Subject to flooding; few outlets; seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot; medium compressibility.
Well drained	Highly erodible on steep slopes.	Some slopes more than 12 percent.	Slope	Poor stability; medium compressibility.
Subject to flooding; slow permeability; few outlets; seasonal water table at depth of 0 to ½ foot.	Slow permeability; seasonal water table at depth of 0 to ½ foot; subject to flooding.	Subject to flooding; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot; high shrink-swell potential; high compressibility.
Subject to flooding; seasonal water table at depth of ½ to 1½ feet; few outlets.	Subject to flooding; seasonal water table at depth of ½ to 1½ feet.	Subject to flooding; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet.	Subject to flooding; seasonal water table at depth of ½ to 1½ feet; medium compressibility.
Seasonal water table at depth of 1½ to 2½ feet; fragipan at depth of 26 inches.	Fragipan at depth of 26 inches.	Fragipan at depth of 26 inches.	Fragipan at depth of 26 inches.	Fair stability; medium compressibility; seasonal water table at depth of ½ to 2½ feet.
Subject to flooding; seasonal water table at depth of 0 to ½ foot; few outlets.	Subject to flooding seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Subject to flooding; seasonal water table at depth of 0 to ½ foot; medium to high compressibility.
Seasonal water table at depth of 1½ to 2½ feet; fragipan at depth of 27 inches.	Fragipan at depth of 27 inches.	Fragipan at depth of 27 inches.	Fragipan at depth of 27 inches.	Seasonal water table at depth of 1½ to 2½ feet.
Well drained	Erodible on steep slopes	Some slopes more than 12 percent.	Erodible on steep slopes	Features generally favorable.

TABLE 6.—*Interpretations of*

Soil series, land types, and map symbols	Suitability as a source of—		Soil features affecting—		
				Construction of farm ponds	
	Topsoil	Road fill	Highway location	Reservoir area	Embankment
Uniontown: UnA, UnB, UoC3.	Good in upper 8 inches; fair below 8 inches; silty clay loam.	Fair: A-4 or A-6 material.	Fair stability; medium compressibility.	Moderate permeability.	Fair stability; fair compaction; medium compressibility; subject to piping.
Urban land: Ur. No interpretations made.					
Wakeland: Wa	Fair: seasonal water table at depth of ½ to 1½ feet.	Fair: A-4 material; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; medium compressibility; subject to flooding; subject to liquefaction.	Seasonal water table at depth of ½ to 1½ feet; moderate permeability.	Poor stability; poor compaction; moderate permeability; highly dispersible; medium compressibility.
Waverly: We	Poor: seasonal water table at depth of 0 to ½ foot.	Poor: seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; subject to flooding; subject to liquefaction; high compressibility.	Seasonal water table at depth of 0 to ½ foot; moderate permeability.	Poor stability; poor compaction; moderate permeability; highly dispersible; medium compressibility.
Weinbach: Wh	Fair: seasonal water table at depth of ½ to 1½ feet.	Fair: A-4 or A-6 material; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; medium to high compressibility.	Seasonal water table at depth of ½ to 1½ feet.	Fair stability; fair compaction.
Wellston: WlC, WlC3, WlD, WlE, WlE3.	Good except where slopes are more than 12 percent.	Fair: A-4 or A-6 material; slope.	Slope; bedrock at depth of 3 to 6 feet.	Moderate permeability; bedrock at depth of 3 to 6 feet.	Subject to piping; medium compressibility; fair stability; fair compaction.
Wheeling: WnA, WnB, WnC.	Good	Fair: A-4 material.	Slope	Moderately rapid permeability in substratum.	Subject to piping; moderate permeability.
Wilbur: Wu	Good	Fair: A-4 material; seasonal water table at depth of 1½ to 3 feet.	Seasonal water table at depth of 1½ to 3 feet; medium compressibility; subject to liquefaction; subject to flooding.	Moderate permeability.	Poor stability; poor compaction; moderate permeability; highly dispersible; medium compressibility.
Zanesville: ZaB, ZaC, ZaC3.	Good	Fair: A-4 or A-6 material; seasonal water table at depth of 2 to 2½ feet.	Seasonal water table at depth of 2 to 2½ feet; bedrock at depth of 4 to 6 feet; slope.	Features generally favorable.	Seasonal water table at depth of 2 to 2½ feet; fair stability; fair compaction.

engineering properties of the soils—Continued

Soil features affecting—Continued				
Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways	Foundations for buildings
Well drained or moderately well drained.	Features generally favorable.	Features generally favorable.	Erodible on steep slopes	Fair stability; medium compressibility.
Seasonal water table at depth of ½ to 1½ feet; few outlets; subject to flooding.	Seasonal water table at depth of ½ to 1½ feet; subject to flooding.	Subject to flooding; seasonal water table at depth of ½ to 1½ feet; slope.	Seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; medium compressibility; subject to flooding.
Seasonal water table at depth of 0 to ½ foot; few outlets; subject to flooding.	Seasonal water table at depth of 0 to ½ foot; subject to flooding.	Subject to flooding; seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot.	Seasonal water table at depth of 0 to ½ foot; medium compressibility; subject to flooding
Slow permeability; few outlets; water table at depth of ½ to 1½ feet.	Slowly permeable; fragipan at depth of 24 inches; seasonal water table at depth of ½ to 1½ feet.	Slope; seasonal water table at depth of ½ to 1½ feet.	Fragipan at depth of 24 inches; seasonal water table at depth of ½ to 1½ feet.	Seasonal water table at depth of ½ to 1½ feet; fair stability; medium to high compressibility.
Well drained	Highly erodible on steep slopes.	Some slopes more than 12 percent; bedrock at depth of 3 to 6 feet.	Highly erodible on steep slopes.	Bedrock at depth of 3 to 6 feet; medium compressibility; slope.
Well drained	Features generally favorable.	Features generally favorable.	Erodible on steep slopes	Features generally favorable.
Seasonal water table at depth of 1½ to 3 feet; few outlets; subject to flooding.	Subject to flooding	Subject to flooding; nearly level.	Features generally favorable.	Seasonal water table at depth of 1½ to 3 feet; medium compressibility; subject to flooding.
Well drained or moderately well drained.	Features generally favorable.	Fragipan at depth of 26 inches; slope; bedrock at depth of 4 to 6 feet.	Fragipan at depth of 26 inches; slope; erodible.	Seasonal water table at depth of 2 to 2½ feet; medium to high compressibility; bedrock at depth of 4 to 6 feet.

TABLE 7.—*Engineering*

[Laboratory data provided by Division of Research,

Soil name and location	Parent material	Report No. SKY68-	Depth from surface	Moisture density [1]		California bearing ratio	
				Maximum dry density	Optimum moisture	Unsoaked	Soaked
			In.	*Lb. per cu. ft.*	*Pct.*		
Belknap silt loam: Daviess County; ½ mile NE. of Masonville, 300 ft. N. of Masonville-Habit Road, 100 ft. W. of private road. (Finer textured in 12–33 inch horizon than modal)	Alluvium.	30–7	12–33	104	16	39	12
			33–54	108	15	17	7
			54–70	107	16	32	7
Ginat silt loam: Daviess County; 2 miles S. of Stanley, 200 ft. W. of Birk City-Stanley Road, 20 ft. N. of old fence row. (Modal)	Ohio River alluvium.	30–4	10–26	103	19	36	5
			26–40	102	19	25	3
			50–65	102	19	35	3
Memphis silt loam: Daviess County; 4 miles E. of Owensboro, ½ mile S. of Reid Road, 50 ft. E. of Thruston-Dermont Road. (Modal)	Loess.	30–1	8–30	103	18	31	14
			45–60	103	18	29	14
Otwell silt loam: Daviess County; 2 miles S. of Stanley, ½ mile S. of Sauer Lane, W. side of Ky. Road 1554. (Modal)	Ohio River alluvium.	30–2	8–18	105	17	32	11
			24–44	102	20	36	5
			44–60	103	17	44	5
Patton silt loam: Daviess County; 2 miles W. of Owensboro, ¼ mile S. of U.S. Highway No. 60, 100 ft. E. of Worthington Road. (Modal)	Alluvium.	30–3	10–18	101	18	21	9
			18–36	106	17	19	8
			36–60	107	16	26	7
Wheeling loam: Daviess County; 2 miles W. of Maceo, 200 ft. S. of Iceland Road, 200 ft. SE. of a tree. (Coarser textured than modal)	Ohio River alluvium.	30–6	0–7	115	11	46	29
			7–24	120	13	36	33
			30–48	115	12	63	43

[1] Based on AASHO Designation: T 99–57 (*2*).

[2] Performed according to AASHO Designation: T 88–57 (*2*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 milli-

test data

Kentucky Department of Highways, Lexington, Ky.]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification		Specific gravity
Percentage less than 3 inches passing sieve—			Percentage smaller than—						AASHO	Unified [4]	
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.					
							Pct.				*Gm. per cu. cm.*
100	98	96	88	58	29	22	[3] NP	[3] NP	A-4(0)	ML	2.62
100	98	96	83	55	24	18	NP	NP	A-4(0)	ML	2.64
100	98	93	70	70	17	10	29	10	A-4(8)	CL	2.71
99	94	90	86	72	43	29	33	9	A-4(8)	CL-ML	2.60
100	95	90	86	75	46	30	36	10	A-4(8)	ML-CL	2.72
100	96	90	83	74	53	37	39	15	A-6(10)	CL-ML	2.74
----------	----------	100	83	46	30	27	35	9	A-4(8)	ML-CL	2.70
----------	----------	100	77	49	19	14	NP	NP	A-4(0)	ML	2.68
100	98	90	86	60	35	25	30	6	A-4(8)	CL-ML	2.71
100	94	89	85	73	40	27	39	12	A-6(9)	ML-CL	2.71
----------	100	98	97	87	52	36	38	14	A-6(10)	CL-ML	2.70
99	98	97	71	51	31	24	42	16	A-7-6(11)	CL-ML	2.67
100	98	97	78	58	37	27	37	14	A-6(10)	CL-ML	2.65
99	96	96	85	61	34	26	33	12	A-6(9)	CL-ML	2.65
100	99	50	35	28	13	10	NP	NP	A-4(0)	SM	2.64
----------	100	52	38	33	21	17	NP	NP	A-4(0)	ML	2.69
----------	100	46	29	19	12	9	NP	NP	A-4(0)	SM	2.65

meters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[3] NP means nonplastic.

[4] Soils that have a plasticity index within two points of the A-line on the plasticity chart are given a borderline classification, such as CL-ML.

In the Unified system (*31*), soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Stand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Estimated soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. A complete description of each soil is given in the section "Descriptions of the Soils." Following are explanations of some of the columns in table 5.

Estimates for depth to bedrock generally are limited to 6 feet, the normal depth of soil survey investigations. Estimates for depths greater than 6 feet are based on the boring records of oil, water, and gas wells; records of other deep borings or excavations; and on geological reports (*17*) concerning the survey area.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture (*25*). These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available moisture capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH value. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Engineering interpretations of soils

Table 6 contains information useful to engineers and others who plan to use soil as material in construction of highways, buildings, or farm facilities, or as a source of topsoil. Ratings and interpretations in this table are based on information in table 5, on available test data, and on field experience. Features that favor or that limit a soil's use for the stated purpose are shown. Interpretations are based on the following criteria.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings are the thickness of suitable material and ease of excavation at the site from which topsoil is taken.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. A seasonal high water table, shrink-swell potential, and traffic-supporting capacity are soil features that affect geographic location of highways.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have

low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compatibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to fragipan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and of fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Grassed waterways are natural or constructed waterways, generally broad and shallow, used to conduct surface water from cropland. Selection is determined by those soil features that affect establishment, growth, and maintenance of plants and the layout and construction of the waterway.

Foundations for buildings are affected chiefly by features of the undisturbed soil that influence its capacity to support low buildings that have a normal foundation load. Also considered are slope, susceptibility to flooding, seasonal wetness, and other hydrologic conditions.

Engineering test data

Table 7 contains the results of engineering tests performed by the Kentucky Department of Highways on several extensive soils in Daviess County. Together the soils tested comprise 28 percent of the survey area. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

The California bearing ratio is the load-supporting capacity of a soil compared to that of a standard crushed limestone, expressed as a ratio and multiplied by 100.

Mechanical analyses show the amount of the various soil separates in a soil sample, usually expressed as weight percentages. Most sand and other material coarser than 0.074 millimeter in diameter do not pass through the No. 200 sieve; silt and clay do pass through. Silt is material between 0.002 and 0.05 millimeter in diameter, and clay is material less than 0.002 millimeter in diameter. The clay fraction was determined by use of the hydrometer method, rather than by the pipette method used by most soil scientists in determining the amount of clay in a soil sample.

Liquid limit and plasticity index measure the effect of water on the strength and consistence of soil material. As the moisture content of a soil is increased from a dry state, the material changes from a solid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Specific gravity is the weight of the soil solids, excluding pore space, compared to the weight of an equal volume of water at a specified temperature.

Use of Soils for Town and Country Planning

The population is increasing in Daviess and Hancock Counties. New industries in the vicinity of Owensboro in Daviess County and in the northern part of Hancock County have expanded the need for residential and recreational uses of rural land. As cities and towns increase in size, and as farmland is developed for homes and industrial uses, additional rural areas are needed on which to locate public utilities and other facilities. The result is a continuing trend toward diverting farmland to nonfarm purposes.

Soils are an important factor in planning most nonfarm uses of land. The interpretations in this section indictate soil-related limitations that can be expected where land in the survey area is developed for nonfarm uses. The rest of this publication also offers much information that will be helpful in planning and developing such areas and in solving the problems that arise as land use changes. Planning officials, developers, homeowners, and others can find information about the soils on the maps and in the section "Descriptions of the Soils." In the subsection "Engineering Uses of the Soils," tables indicate engineering properties of the soils and give interpretations of these properties.

Table 8 shows the estimated degree and kind of soil limitations for specified uses in town and country planning. The information given in table 8 is not intended to eliminate the need for onsite investigations for specific projects but rather to serve as a guide for screening sites and for planning more detailed onsite investigations.

TABLE 8.—*Interpretations of the soils for*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which have of this

Soil series, land types, and map symbols	Estimated degree and kind of limitation for use as— Sewage lagoons	Septic tank filter fields	Sites for homes or recreational buildings	Streets and low-cost roads	Lawns, landscaping, and golf fairways
Alluvial land, steep: AlF. Variable, not rated.					
Ashton: As	Severe: subject to flooding.	Severe: subject to flooding; moderate permeability.	Severe: subject to flooding.	Severe: subject to flooding; fair traffic-supporting capacity.	Moderate: subject to flooding.
Belknap: Be	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; fair traffic-supporting capacity; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.
Bruno: Bu	Severe: rapid permeability; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; sandy surface layer.
Calloway: Ca	Slight	Severe: slow permeability; seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Moderate: seasonal high water table.
Clifty: Cg	Severe: subject to flooding; moderately rapid permeability.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Collins: Co	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; fair traffic-supporting capacity; seasonal high water table.	Moderate: subject to flooding.
Elk:					
EkA	Moderate: moderate permeability.	Slight	Slight	Moderate: fair traffic-supporting capacity.	Slight
EkB	Moderate: moderate permeability; slope.	Slight	Slight	Moderate: fair traffic-supporting capacity.	Slight
EkC	Severe: slope	Moderate: slope	Moderate: slope	Moderate: fair traffic-supporting capacity; slope.	Moderate: slope
EkE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
ElC3	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope; fair traffic-supporting capacity.	Severe: slope; erosion.

stated uses in town and country planning

different interpretations. For this reason the reader should follow carefully the instructions for referring to another series in the first column table]

Estimated degree and kind of limitation for use as—Continued				
Cemeteries	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: subject to flooding.	Moderate: subject to flooding; moderate permeability.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Severe: subject to flooding; seasonal high water table.	Severe: seasonal high water table; subject to flooding.	Moderate: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: subject to flooding; sandy surface layer.	Moderate: subject to flooding; sandy surface layer.	Moderate: subject to flooding; sandy surface layer.	Severe: subject to flooding; sandy surface layer.	Moderate: sandy surface layer.
Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.
Severe: subject to flooding.	Severe: coarse fragments on surface; subject to flooding.	Moderate: subject to flooding; coarse fragments on surface.	Severe: subject to flooding.	Moderate: coarse fragments on surface.
Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Slight	Slight	Slight	Slight	Slight.
Slight	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope; erosion.	Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.

TABLE 8.—*Interpretations of the soils for*

Soil series, land types, and map symbols	Estimated degree and kind of limitation for use as—				
	Sewage lagoons	Septic tank filter fields	Sites for homes or recreational buildings	Streets and low-cost roads	Lawns, landscaping, and golf fairways
*Frondorf:					
FwD, FwD3. For Wellston part, see Wellston series.	Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: bedrock at depth of 1½ to 3½ feet; slope.	Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: slope.
FwE, FwE3, FwF. For Wellston part, see Wellston series.	Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: bedrock at depth of 1½ to 3½ feet; slope.	Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: slope; erosion.
Ginat: Gn	Slight	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table; fair traffic-supporting capacity.	Severe: seasonal high water table.
Grenada:					
GrA	Slight	Severe: slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Slight.
GrB	Moderate: slope	Severe: slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Slight.
Gullied land: Gu. Variable, not rated.					
Henshaw: He	Slight	Severe: moderately slow permeability; seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Moderate: seasonal high water table.
Huntington: Hu	Severe: subject to flooding; moderate permeability.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; fair traffic-supporting capacity.	Moderate: subject to flooding.
Jacob: Ja	Severe: subject to flooding.	Severe: seasonal high water table; moderately slow permeability; subject to flooding.	Severe: subject to flooding; seasonal high water table; moderate to high shrink-swell potential.	Severe: seasonal high water table; subject to flooding; poor traffic-supporting capacity.	Severe: seasonal high water table; subject to flooding; silty clay loam surface layer.
Karnak:					
Ka	Severe: subject to flooding.	Severe: slow permeability; seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table; very high shrink-swell potential.	Severe: seasonal high water table; subject to flooding; poor traffic-supporting capacity.	Severe: seasonal high water table; subject to flooding.
Kc	Severe: subject to flooding.	Severe: slow permeability; seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table; very high shrink-swell potential.	Severe: seasonal high water table; subject to flooding; poor traffic-supporting capacity.	Severe: seasonal high water table; clayey surface layer; subject to flooding.

stated uses in town and country planning—Continued

Estimated degree and kind of limitation for use as—Continued				
Cemeteries	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope; bedrock at depth of 1½ to 3½ feet.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.
Severe: slow permeability.	Moderate: seasonal high water table; slow permeability.	Slight	Moderate: slow permeability; seasonal high water table.	Slight.
Severe: slow permeability.	Moderate: seasonal high water table; slow permeability; slope.	Slight	Moderate: slow permeability; seasonal high water table.	Slight.
Severe: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Severe: seasonal high water table; subject to flooding; silty clay loam surface layer.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: seasonal high water table; silty clay loam surface layer.
Severe: subject to flooding; seasonal high water table; slow permeability.	Severe: seasonal high water table; subject to flooding; slow permeability.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table; slow permeability.	Severe: seasonal high water table.
Severe: seasonal high water table; subject to flooding; clayey surface layer; slow permeability.	Severe: seasonal high water table; clayey surface layer; subject to flooding; slow permeability.	Severe: seasonal high water table; clayey surface layer; subject to flooding.	Severe: subject to flooding; seasonal high water table; slow permeability; clayey surface layer.	Severe: seasonal high water table; clayey surface layer.

TABLE 8.—*Interpretations of the soils for*

Soil series, land types, and map symbols	Estimated degree and kind of limitation for use as—				
	Sewage lagoons	Septic tank filter fields	Sites for homes or recreational buildings	Streets and low-cost roads	Lawns, landscaping, and golf fairways
Lakin: LaA	Severe: rapid permeability.	Slight	Slight	Slight	Moderate: sandy surface layer.
Lindside: Ld	Severe: subject to flooding; moderate permeability.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; fair traffic-supporting capacity.	Moderate: subject to flooding.
Loring: LoA	Slight	Severe: slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Slight
LoB	Moderate: slope	Severe: slow permeability	Moderate: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Slight
LoC	Severe: slope	Severe: slow permeability.	Moderate: slope	Moderate: slope; fair traffic-supporting capacity.	Moderate: slope
LoD	Severe: slope	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope
LrC3	Severe: slope	Severe: slow permeability.	Moderate: slope	Moderate: slope; fair traffic-supporting capacity.	Severe: slope; erosion.
LrD3	Severe: slope	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope; erosion.
McGary: Mc	Slight	Severe: slow permeability; seasonal high water table.	Severe: seasonal high water table; moderate to high shrink-swell potential.	Moderate: moderate to high shrink-swell potential; fair traffic-supporting capacity; seasonal high water table.	Moderate: seasonal high water table.
Markland: MdA	Slight	Severe: slow permeability.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Slight
MdE	Severe: slope	Severe: slow permeability; slope.	Severe: slope; high shrink-swell potential.	Severe: slope	Severe: slope
MeB2	Moderate: slope	Severe: slow permeability.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Moderate: silty clay loam surface layer.
MfC3	Severe: slope	Severe: slow permeability.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: slope; clayey surface layer; erosion.
MfE3	Severe: slope	Severe: slow permeability; slope.	Severe: slope; high shrink-swell potential.	Severe: high shrink-swell potential; slope; poor traffic-supporting capacity.	Severe: slope; erosion; clayey surface layer.

stated uses in town and country planning—Continued

Estimated degree and kind of limitation for use as—Continued				
Cemeteries	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.
Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Severe: slow permeability.	Moderate: slow permeability.	Slight.	Moderate: slow permeability.	Slight.
Severe: slow permeability.	Moderate: slow permeability; slope.	Slight.	Moderate: slow permeability.	Slight.
Severe: slow permeability.	Severe: slope.	Moderate: slope.	Moderate: slope; slow permeability.	Slight.
Severe: slow permeability; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Severe: slow permeability; slope; erosion.	Severe: slope.	Moderate: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.
Severe: slow permeability; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: silty clay loam surface layer; slope.
Severe: slow permeability; seasonal high water table.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: slow permeability.	Moderate: slow permeability.	Slight.	Moderate: slow permeability.	Slight.
Severe: slow permeability; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Severe: slow permeability.	Moderate: slow permeability; slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: slow permeability; silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Severe: slow permeability; slope; erosion; clayey surface layer.	Severe: slope; clayey surface layer.	Severe: clayey surface layer.	Severe: clayey surface layer.	Severe: clayey surface layer.
Severe: slow permeability; slope; erosion; clayey surface layer.	Severe: slope; clayey surface layer.	Severe: slope; clayey surface layer.	Severe: slope; clayey surface layer.	Severe: slope; clayey surface layer.

TABLE 8.—*Interpretations of the soils for*

Soil series, land types, and map symbols	Estimated degree and kind of limitation for use as—				
	Sewage lagoons	Septic tank filter fields	Sites for homes or recreational buildings	Streets and low-cost roads	Lawns, landscaping, and golf fairways
Melvin: Mh	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; fair traffic-supporting capacity.	Severe: seasonal high water table; subject to flooding.
Memphis:					
MmA	Moderate: moderate permeability.	Slight	Slight	Moderate: fair traffic-supporting capacity.	Slight
MmB	Moderate: moderate permeability; slope.	Slight	Slight	Moderate: fair traffic-supporting capacity.	Slight
MmC	Severe: slope	Moderate: slope	Moderate: slope	Moderate: fair traffic-supporting capacity; slope.	Moderate: slope
MmE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
MmF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
MnC3	Severe: slope	Moderate: slope	Moderate: slope	Moderate: fair traffic-supporting capacity; slope.	Severe: slope; erosion.
MnE3	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; erosion.
Montgomery: Mo	Severe: subject to flooding.	Severe: slow permeability; seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding; high shrink-swell potential.	Severe: high shrink-swell potential; seasonal high water table; poor traffic-supporting capacity.	Severe: seasonal high water table; subject to flooding; silty clay loam surface layer.
Newark: Ne	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table; fair traffic-supporting capacity.	Moderate: seasonal high water table; subject to flooding.
Otwell:					
OtA	Slight	Severe: slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Slight
OtB	Moderate: slope	Severe: slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Slight
Patton:					
Pa	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding; fair traffic-supporting capacity.	Severe: seasonal high water table; subject to flooding.
Ph	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding; fair traffic-supporting capacity.	Severe: seasonal high water table; subject to flooding.

stated uses in town and country planning—Continued

Estimated degree and kind of limitation for use as—Continued				
Cemeteries	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: seasonal high water table.
Slight	Slight	Slight	Slight	Slight.
Slight	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope; erosion.	Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Severe: slope; erosion.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; silty clay loam surface layer.
Severe: seasonal high water table; subject to flooding; slow permeability; silty clay loam surface layer.	Severe: seasonal high water table; subject to flooding; silty clay loam surface layer.	Severe: seasonal high water table; subject to flooding; silty clay loam surface layer.	Severe: seasonal high water table; silty clay loam surface layer; subject to flooding.	Severe: seasonal high water table; silty clay loam surface layer.
Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Moderate: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: slow permeability.	Moderate: slow permeability; seasonal high water table.	Slight	Moderate: slow permeability; seasonal high water table.	Slight.
Severe: slow permeability.	Moderate: slow permeability; seasonal high water table; slope.	Slight	Moderate: slow permeability; seasonal high water table.	Slight.
Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table.
Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table.

TABLE 8.—*Interpretations of the soils for*

Soil series, land types, and map symbols	Estimated degree and kind of limitation for use as— Sewage lagoons	Septic tank filter fields	Sites for homes or recreational buildings	Streets and low-cost roads	Lawns, landscaping, and golf fairways
Sciotoville: ScA	Moderate: moderately rapid permeability in substratum.	Severe: slow permeability in fragipan.	Moderate: seasonal high water table.	Moderate: fair traffic-supporting capacity; seasonal high water table.	Slight.
Shelocta:					
ShC	Severe: slope.	Moderate: slope.	Moderate: slope.	Moderate: slope.	Moderate: slope.
ShD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Strip mine spoil: St. Variable, not rated.					
Uniontown:					
UnA	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight.	Moderate: fair traffic-supporting capacity.	Slight.
UnB	Moderate: slope; moderate permeability.	Moderate: moderate permeability.	Slight.	Moderate: fair traffic-supporting capacity.	Slight.
UoC3	Severe: slope.	Moderate: slope; moderate permeability.	Moderate: slope.	Moderate: fair traffic-supporting capacity; slope.	Severe: slope; erosion.
Urban land: Ur. Variable, not rated.					
Wakeland: Wa	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table; fair traffic-supporting capacity.	Moderate: seasonal high water table; subject to flooding.
Waverly: We	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table; fair traffic-supporting capacity.	Severe: seasonal high water table; subject to flooding.
Weinbach: Wh	Slight.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Moderate: seasonal high water table; fair traffic-supporting capacity.	Moderate: seasonal high water table.
Wellston:					
WlC	Severe: slope.	Moderate: bedrock at depth of 3 to 6 feet; slope.	Severe: bedrock at depth of 3 to 6 feet; slope.	Severe: slope; fair traffic-supporting capacity; bedrock at depth of 3 to 6 feet.	Moderate: slope.
WlC3	Severe: slope.	Moderate: bedrock at depth of 3 to 6 feet; slope.	Severe: slope; bedrock at depth of 3 to 6 feet.	Severe: slope; fair traffic-supporting capacity; bedrock at depth of 3 to 6 feet.	Severe: slope; erosion.
WlD	Severe: slope.	Severe: bedrock at depth of 3 to 6 feet; slope.	Severe: slope; bedrock at depth of 3 to 6 feet.	Severe: slope; bedrock at depth of 3 to 6 feet.	Severe: slope.
WlE	Severe: slope.	Severe: bedrock at depth of 3 to 6 feet.	Severe: slope; bedrock at depth of 3 to 6 feet.	Severe: slope.	Severe: slope.

stated uses in town and country planning—Continued

Estimated degree and kind of limitation for use as—Continued				
Cemeteries	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: slow permeability in fragipan.	Moderate: slow permeability; seasonal high water table.	Slight	Moderate: slow permeability; seasonal high water table.	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Slight	Slight	Slight	Slight	Slight.
Slight	Moderate: slope	Slight	Slight	Slight.
Severe: slope; erosion.	Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Moderate: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table.
Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.
Moderate: slope; bedrock at depth of 3 to 6 feet.	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope; erosion; bedrock at depth of 3 to 6 feet.	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 8.—*Interpretations of the soils for*

Soil series, land types, and map symbols	Estimated degree and kind of limitation for use as—				
	Sewage lagoons	Septic tank filter fields	Sites for homes or recreational buildings	Streets and low-cost roads	Lawns, landscaping, and golf fairways
WlE3	Severe: slope	Severe: bedrock at depth of 3 to 6 feet; slope.	Severe: slope; bedrock at depth of 3 to 6 feet.	Severe: slope; bedrock at depth of 3 to 6 feet.	Severe: slope; erosion.
Wheeling:					
WnA	Severe: moderately rapid permeability in substratum.	Slight	Slight	Moderate: fair traffic-supporting capacity.	Slight
WnB	Severe: moderately rapid permeability in substratum.	Slight	Slight	Moderate: fair traffic-supporting capacity.	Slight
WnC	Severe: moderately rapid permeability in substratum; slope.	Moderate: slope	Moderate: slope	Moderate: fair traffic-supporting capacity; slope.	Moderate: slope
Wilbur: Wu	Severe: subject to flooding; moderate permeability.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table; fair traffic-supporting capacity.	Moderate: subject to flooding.
Zanesville:					
ZaB	Moderate: slope; bedrock at depth of 4 to 6 feet.	Severe: slow permeability.	Moderate: bedrock at depth of 4 to 6 feet; seasonal high water table.	Moderate: fair traffic-supporting capacity; seasonal high water table; bedrock at depth of 4 to 6 feet.	Slight
ZaC	Severe: slope	Severe: slow permeability.	Moderate: bedrock at depth of 4 to 6 feet; slope.	Moderate: slope; fair traffic-supporting capacity; bedrock at depth of 4 to 6 feet.	Moderate: slope
ZaC3	Severe: slope	Severe: slow permeability.	Moderate: bedrock at depth of 4 to 6 feet; slope.	Moderate: slope; fair traffic-supporting capacity; bedrock at depth of 4 to 6 feet.	Severe: slope; erosion.

stated uses in town and country planning—Continued

Estimated degree and kind of limitation for use as—Continued				
Cemeteries	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: slope; erosion.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Slight	Slight	Slight	Slight	Slight.
Slight	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Severe: slow permeability.	Moderate: slope; slow permeability.	Slight	Moderate: slow permeability.	Slight.
Severe: slow permeability; slope.	Severe: slope	Moderate: slope	Moderate: slope; slow permeability.	Slight.
Severe: slow permeability; slope; erosion.	Severe: slope	Moderate: slope	Moderate: slope; slow permeability.	Slight.

The land types Alluvial land, steep (AlF), Gullied land (Gu), Strip mine spoil (St), and Urban land (Ur) are not rated in table 8, because their properties are variable and may not be suitable for the intended use. Such areas must be given onsite investigation if their use is considered.

Soils of the county are given a rating of *slight*, *moderate*, or *severe* according to their degree of limitation for town and country planning. A rating of *slight* means that the limitations, if any, are of only minor consequence and are easy to overcome. A rating of *moderate* means that limitations are of a magnitude to require careful planning, design, and management. Cost of corrective measures is an important consideration. A rating of *severe* means that limitations are serious enough that cost of corrective measures may be too high to justify the intended use of the soil or site. The main limitation or limitations are given if the rating is moderate or severe. Some kinds of limitations are expressed in terms that may not be familiar or that have a special meaning. These terms are defined in the Glossary in the back of this survey.

Various criteria were used in determining the degrees and kinds of soil-related limitations indicated for uses specified in table 8. The ratings are explained in the following paragraphs.

Sewage lagoons are shallow ponds used for the disposal of sewage by oxidation. Among the features used as a basis for rating the suitability of the soils for this purpose are permeability, depth to bedrock, slope, kind of soil material at the site, quantity of coarse fragments, content of organic matter in the soil, and the hazard of flooding.

Septic tank filter fields are soil absorption systems for disposing of sewage. They consist of subsurface tile systems laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil. The soil material from a depth of 18 inches to a depth of 6 feet is evaluated. Criteria used for rating soils for use as absorption fields are soil permeability, depth to seasonal high water table, the hazard of flooding, slope, and depth to bedrock. Possible pollution of a source of water supply is not considered; but where such a hazard exists, it is severe.

Homes or recreational service buildings are not more than three stories high and have a basement. Ratings for these uses are based on depth to seasonal high water table, slope, depth to bedrock, shrink-swell potential, surface rockiness and stoniness, and the hazard of flooding. Where such buildings are constructed without a basement, depth to bedrock or a seasonal high water table are less restrictive.

Streets and low-cost roads have a hard, all-weather surface and are expected to carry automobile traffic all year in residential and rural areas. Highways for heavy cross-country traffic are not included. Among the soil features affecting streets and low-cost roads are depth to a seasonal high water table, slope, depth to bedrock, traffic-supporting capacity, surface rockiness and stoniness, the hazard of flooding, and shrink-swell potential.

For lawns, landscaping, and golf fairways, it is assumed that soil material at the site will be used rather than hauled-in fill or topsoil. The ratings are based on depth to seasonable high water table, slope, past erosion, depth to bedrock, surface rockiness and stoniness, texture of the surface layer, and the hazard of flooding.

For community-type cemeteries, it is assumed that soil material at the site will be used rather than hauled-in fill or topsoil. Among the soil features considered are depth to seasonal high water table, slope, past erosion, permeability, depth to bedrock, surface rockiness and stoniness, texture of the surface layer, and the hazard of flooding.

Playgrounds are areas used intensively for baseball, football, and volleyball. Soils suitable for this use are ones that can withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops. They also have good drainage, are free of flooding during periods of heavy use, and they have a surface that is firm after rains but that is not dusty when dry. Ratings are based on slope, permeability, depth to bedrock, surface rockiness and stoniness, texture of the surface layer, the hazard of flooding, and depth to seasonal high water table.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. The soils should be firm when wet but not dusty when dry. Ratings are based on depth to seasonal high water table, slope, surface stoniness and rockiness, texture of the surface layer, the hazard of flooding, and quantity of coarse fragments on the surface. These factors are less restrictive for picnic areas than they are for playgrounds.

Camp areas are used intensively for tents and small camp trailers. It is assumed that little preparation of the site will be required other than leveling for tents and parking. The ratings are based on such soil features as depth to seasonal high water table, the hazard of flooding, soil permeability, slope, texture of the surface layer, surface stoniness and rockiness, and quantity of coarse fragments on the surface.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The features used for rating soils for these uses are depth to seasonal high water table, slope, surface rockiness and stoniness, texture of the surface layer, quantity of coarse fragments, and the hazard of flooding.

Formation and Classification of the Soils

This section lists the factors of soil formation and discusses the effects these five factors have had on the formation of soils in the survey area. It also explains the current system of classification, places the soils in some higher categories, and gives a brief discussion of laboratory analysis. The soil series in the survey area and a profile representative for each series are described in the section "Descriptions of the Soils."

Formation of Soils

The characteristics of a soil at any given point depend on the physical and chemical composition of the parent material, on climate, on plant and animal life, on relief,

and on time. Soil is formed by the interaction of these five factors. The relative importance of each factor differs from one area to another. In some places one factor may dominate in determining the characteristics of the soils, and another factor may dominate in other areas. Climate and plant and animal life are not likely to vary much over an area the size of one or two to three adjacent counties, but many local differences in soils may have been caused by differences in relief and parent material. Because the interrelationships among these five factors are complex, the effects of any one factor are difficult to determine.

Parent material

Parent material is the unconsolidated mass of geologic material from which soils have formed. Most of the soils in the survey area have formed either in loess or in alluvium. Some, however, have formed in a thin deposit of loess and in the underlying residuum weathered from sandstone, siltstone, and shale.

Loess was deposited in this area by wind during the glacial ages, and it is the parent material of most of the soils on uplands. In most parts of the survey area, the mantle of loess is 3 to 50 feet thick. In gently sloping areas in the southeastern part of the survey area, the mantle is only about 3 feet thick, but it is as thick as 50 feet in the northern part of the survey area. In some areas of steep soils, the mantle of loess is thin or absent. At the time the loess was deposited, it was apparently calcareous, for some of the deepest deposits still have calcium carbonate in the lower part. Among soils on uplands that have formed entirely in deposits of loess are the Memphis, Loring, Grenada, and Calloway soils.

In this survey area, the bedrock is mostly sandstone and interbedded siltstone and shale of the Pennsylvanian Formation (*13*). Most of the soils on uplands in the central and southern parts of Hancock County have formed in a layer of loess 1 to 3 feet thick and in the underlying residuum weathered from sandstone, siltstone, and shale. Among the soils that have formed both in loess and in the underlying residual material are those of the Zanesville, Wellston, and Frondorf series.

Alluvial deposits are extensive along the major streams. Both the Ohio River and the Green River drain large areas. Waters from these two rivers have brought to the survey area mixed sediment (fig. 20) washed from areas containing the different kinds of parent material in the drainage basins of those rivers. Sedimentary rocks, consisting of sandstone, siltstone, shale, and limestone, are extensive in the watersheds of both rivers. Loess has covered large areas of both watersheds, and the area north of the Ohio River contains extensive areas of glacial drift. Sediment from those areas has weathered in varying degrees, and it contains a mixture of mineral material.

The sediment deposited by the rivers is variable in texture. Sandy sediment near the Ohio River is the parent material of Lakin and Bruno soils. Among soils formed in finer textured terrace sediment are the Elk, Sciotoville, Weinbach, and Ginat soils.

Along tributaries of the Ohio River are soils on stream terraces and bottom lands that are the remains of old flood plains of an earlier period. These soils are on wide

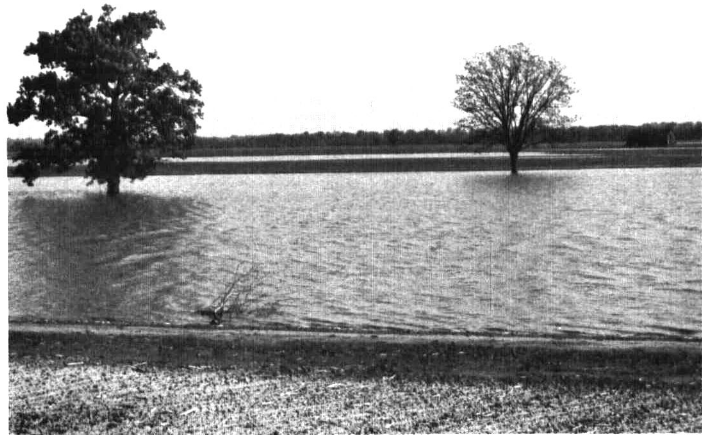


***Figure 20.*—Low area flooded by backwater from the Ohio River. This area is generally flooded in winter and in spring. Fertile sediment is usually left when the floodwaters recede.**

flats and are at a few feet higher elevation than those formed in sediment deposited by the Ohio River. During the glacial period, ice and debris blocked the channel of the Ohio River. As a result, large lakes formed in the valleys of the tributary streams. After the present channel of the Ohio River was reestablished, sediment deposited in the quiet slack water of these lakes became the parent material of fine-textured soils of the Markland, McGary, Montgomery, and Karnak series. Uniontown, Henshaw, and Patton soils formed in similar sediment, but the sediment in which they formed contained more silt, presumably from loess, than the parent material of the Markland, McGary, Montgomery, and Karnak soils.

Climate

The temperate, humid climate of Daviess and Hancock Counties presumably is similar to the climate in this area during the period when the soils were forming. Warm temperatures and abundant rainfall have permitted rapid development of a profile in the soils. The soils are moist much of the time and are frozen for only short periods. Thus, the development of soil profiles has been almost continuous.

Movement of water downward through the soil causes the leaching of soluble substances and the downward movement of clay. Some substances are relocated in the lower part of the soil, and some are completely removed. Most of the soils are acid because soluble bases have been leached out. In the Uniontown and Henshaw soils, concretions of calcium carbonate in the lower part of the subsoil have resulted from leaching of the upper part of the soil profile. Some clay minerals have moved from the surface layer to the subsoil in most soils on uplands. Rainfall and temperature also influence the growth, death, and decay of soil organisms and affect their other activities. These organisms, in turn, influence the development of the soil profile.

Climate is relatively uniform throughout the survey area. Therefore, most differences among the soils are apparently attributable to factors other than climate. Additional information about the climate of the survey area

can be found under the heading of "Climate" in the section "General Nature of the Area."

Plant and animal life

Plants and animals are active forces that affect the formation of soils. Plants have had a greater influence than animals on the formation of soils in the survey area. Plants transfer nutrients from the subsoil to the surface layer, and they supply organic matter to the soils.

Older soils in the survey area reflect the influence of hardwood forests. These soils are acid and have a thin, dark surface layer; a leached subsurface layer; and a subsoil that contains more clay than either the surface layer or the substratum. These characteristics are more strongly expressed in the Memphis, Loring, Wellston, and Zanesville soils, and in other older soils on uplands, than in younger soils formed in alluvium.

Soils that formed under grasses and similar vegetation generally have a thicker dark-colored surface layer than soils that formed under forest. The Montgomery and Patton soils are nearly neutral in reaction and have a thick, dark surface layer. This suggests that part of their early development was under grasses, sedges, canes, or other marshy vegetation.

Insects, earthworms, crayfish, rodents, protozoans, bacteria, fungi, and similar organisms have exerted less influence than have plants on properties of the soils. The larger of these organisms have made channels through the soils and have caused minor mixing of the soil material, mostly in the surface layer. Microorganisms have helped to decompose organic matter.

Man's influence on the soils of the survey area has covered only a brief period of time, but man has altered the soils at a rapid rate since he first came to the area. He has mixed the surface layer into a plow layer, has graded and leveled the soils, and has allowed much of the surface layer of soils to be lost through erosion. Man's alterations, however, have been restricted mainly to the surface layer.

Relief

Relief influences the formation of soils and is responsible for many of the differences among soils of the survey area. It has affected drainage, runoff, erosion, and depth of the soils. In the survey area, relief ranges from nearly level to steep.

Most poorly drained and very poorly drained soils are nearly level and are in lower lying areas than adjacent soils. Runoff from these areas is slow, and the soils are saturated for long periods of time. Little or no soil material is lost through geologic erosion. Among such soils are those of the Ginat, Melvin, Waverly, Karnak, Jacob, Patton, and Montgomery series. All of these soils are nearly level. They have a dominantly grayish color, which is characteristic of poorly drained soils.

Most somewhat poorly drained soils are also nearly level. Of these, the Newark, Belknap, and Wakeland soils are on flood plains. They have a water table that extends into the subsoil, and they are flooded periodically. Calloway and Weinbach soils have a fluctuating perched water table above a slowly permeable fragipan. Their subsoil contains both brownish colors, as a result of oxidation, and grayish colors, as a result of reduction.

Most moderately well drained soils are nearly level or gently sloping. The Grenada and Sciotoville soils of the survey area are among these soils. They generally do not receive runoff from areas of other soils. Water moves freely through the upper part of their subsoil, but its movement is restricted below a depth of about 2 feet by a fragipan. Above the fragipan, the soil material mostly has a brownish color.

Collins, Lindside, and Wilbur soils are also moderately well drained. They are on flood plains and are subject to flooding. In these soils the water table is high for long enough periods of time to give rise to some grayish colors in the subsoil, but the upper part of the subsoil is mostly brown.

Well-drained soils range from nearly level to steep. Among the well-drained soils that are nearly level are the Memphis, Elk, and Wheeling soils. Water percolates through these soils at a moderate rate, and the soils are saturated for only brief periods of time. Among well-drained soils that are strongly sloping to steep are the Wellston and Frondorf soils. In these soils geologic erosion is rapid. Only a small amount of water penetrates where these soils are steep, and in those places most of the water from rainfall is lost through runoff. The Wellston and Frondorf soils have formed partly in a thin layer of loess, characteristic of some strongly sloping to steep soils, and partly in material weathered from the underlying bedrock. The Frondorf soils are only moderately deep over bedrock.

Time

Time is required for a soil to be formed from parent material. The length of time that the parent material has been exposed to the active forces of climate and plant and animal life is an important factor in the formation of soils.

Geologically, most of the soils in Daviess and Hancock Counties are relatively young. The oldest soils date from the time of the continental glaciers of the Pleistocene epoch. The last glacial period, the Wisconsin glaciers, began about 25,000 years ago, and it ended about 11,000 years ago. (*19*). The glaciers ended their most forward advance about 100 miles north of Daviess and Hancock Counties.

Loess was deposited during the warning of the ice sheets and during the late Wisconsin glacial stage. Thus, the profiles of the Memphis, Loring, Grenada, and Calloway soils have been developing for about 11,000 to 14,000 years. The upper part of the Wellston, Frondorf, and Zanesville profiles have formed in loess. Therefore, the profiles of those soils probably have been developing for about the same length of time as those of the Memphis, Loring, Grenada, and Calloway soils. The underlying residuum was subjected to weathering before the loess was deposited.

During the glacial period, waters of the Ohio River were high. No doubt, much of the sediment deposited by that river was deposited during the glacial period (*17*). The Elk, Wheeling, Sciotoville, Weinbach, and Ginat soils have formed in material that was carried to the area from glaciated places and was deposited when the river receded from its highest level. The Uniontown, Henshaw, Markland, and McGary soils, on stream ter-

races along tributaries of the Ohio River, began development of a soil profile no later than the end of the Wisconsin period (*23*).

All of these soils have distinct soil horizons and some properties that are common to soils of about the same age. Most of the bases have been leached from the solum, and as a result, the soils are acid. Organic matter has accumulated at the surface, forming a distinct A1 horizon. The soils contain a leached A2 horizon and have a B2 horizon of clay accumulation. The Loring, Grenada, Calloway, Zanesville, Sciotoville, Weinbach, and Ginat soils have a fragipan. The Calloway, Weinbach, Ginat, Henshaw, and McGary soils have grayish colors and contain iron concretions, both of which are characteristics of gleyed soils.

Most soils on flood plains are much younger than the other soils in the survey area. They have weakly developed profile characteristics and indistinct soil horizons. The only indications of development of a soil profile in these soils are an A1 horizon that has been darkened by organic matter, a weakly developed B horizon, and grayish colors in some of the soils that are gleyed. Huntington, Lindside, Newark, Melvin, Wilbur, Wakeland, Collins, Belknap, and Waverly soils are examples of young soils in the survey area.

Classification of Soils

Soils are classified so that we can more readily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation (*7*). First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

In classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and was later revised (*24*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*22*, *26*). Therefore, readers interested in developments of the current system should search the latest literature available. In table 9 soil series of Daviess and Hancock Counties are placed in some categories of the current system of classification and the great soil group of the older system.

The current system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable or measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. The categories in the current system are briefly defined in the following paragraphs.

ORDERS. In the order of the current system of classification, soils are grouped according to common properties that seem to be the result of the same kinds of processes acting to about the same degree on soil material and, by this action, forming horizons. Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols.

The five soil orders in Daviess and Hancock Counties are shown in table 9. They are Entisols, Inceptisols, Mollisols, Alfisols, and Ultisols. Entisols are soils that have little or no evidence of development of soil horizons. Inceptisols are soils that have weakly expressed horizons or the beginnings of such horizons. Mollisols have a thick, dark surface horizon and high base saturation. Alfisols have B horizons of clay accumulation and medium to high base saturation. Ultisols are highly developed soils that have B horizons of clay accumulation and have low base saturation.

SUBORDERS. Each order is subdivided into suborders, primarily of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the order. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is Aquepts (*Aqu*, meaning water or wet, and *ept* from Inceptisol). The suborder is not shown in table 9, because it is indicated in the last word of the subgroup name.

GREAT GROUPS. Soil suborders are separated into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make separations are those in which clay, iron, or humus have accumulated. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquept (*Hapl*, meaning minimum). The great group is not shown separately in table 9, because it is the last word in the name of the subgroup.

SUBGROUPS. Great groups are subdivided into subgroups; one representing the central (typic) segment of the group, and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of the great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of a great group. An example is Typic Haplaquept (a typical Haplaquept).

FAMILIES. Families are separated within a subgroup primarily on the basis of properties important to plant growth. Some of the properties considered are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons. A family name consists of a series of adjective terms relative to certain properties used as family differentiae. An example is fine-silty, mixed, mesic family of Mollic Hapludalfs.

TABLE 9.—*Classification of soil series into higher categories*

Soil series	Current system			Great soil group (1938 classification)
	Family	Subgroup	Order	
Ashton [1]	Fine-silty, mixed, mesic	Mollic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Alluvial soils.
Belknap	Coarse-silty, mixed, acid, mesic.	Aeric Fluvaquents	Entisols	Alluvial soils intergrading toward Low-Humic Gley soils.
Bruno	Sandy, mixed, thermic [2]	Typic Udifluvents	Entisols	Alluvial soils.
Calloway [3]	Fine-silty, mixed, thermic [2]	Glossaquic Fragiudalfs	Alfisols	Planosols that have a fragipan.
Clifty [4]	Fine-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Collins	Coarse-silty, mixed, acid, thermic.[2]	Aquic Udifluvents	Entisols	Alluvial soils.
Elk	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Frondorf	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.
Ginat	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols	Planosols that have a fragipan.
Grenada [3]	Fine-silty, mixed, thermic [2]	Glossic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils that have a fragipan.
Henshaw	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Huntington	Fine-silty, mixed, mesic	Fluventic Hapludolls	Mollisols	Alluvial soils.
Jacob	Fine, montmorillonitic, acid, mesic.	Vertic Haplaquepts	Inceptisols	Alluvial soils.
Karnak	Fine, montmorillonitic, nonacid, mesic.	Vertic Haplaquepts	Inceptisols	Low-Humic Gley soils intergrading toward Alluvial soils.
Lakin [5]	Mixed, mesic	Alfic Udipsamments	Entisols	Regosols intergrading toward Gray-Brown Podzolic soils.
Lindside	Fine-silty, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols	Alluvial soils.
Loring	Fine-silty, mixed, thermic [2]	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils that have a fragipan.
McGary	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols	Planosols.
Markland	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Melvin	Fine-silty, mixed, nonacid, mesic.	Typic Haplaquepts	Inceptisols	Low-Humic Gley soils.
Memphis	Fine-silty, mixed, thermic [2]	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Montgomery	Fine, mixed, mesic	Typic Haplaquolls	Mollisols	Humic Gley soils.
Newark	Fine-silty, mixed, nonacid, mesic.	Aeric Fluvaquents	Entisols	Alluvial soils intergrading toward Low-Humic Gley soils.
Otwell	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils that have a fragipan.
Patton	Fine-silty, mixed, mesic	Typic Haplaquolls	Mollisols	Humic Gley soils.
Sciotoville	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils that have a fragipan.
Shelocta	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Uniontown	Fine-silty, mixed, mesic,	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Wakeland	Coarse-silty, mixed, nonacid, mesic.	Aeric Fluvaquents	Entisols	Alluvial soils intergrading toward Low-Humic Gley soils.
Waverly	Coarse-silty, mixed, acid, thermic.[2]	Typic Fluvaquents	Entisols	Low-Humic Gley soils.
Weinbach	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols	Planosols that have a fragipan.
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.
Wheeling [7]	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Wilbur	Coarse-silty, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols	Alluvial soils.
Zanesville	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols	Red-Yellow Podzolic soils that have a fragipan.

[1] Ashton soils in this survey area are taxadjuncts to the series. They have slightly more clay in the B horizon and a thicker solum than is defined for the series.

[2] This survey area is near the boundary of the mesic-thermic temperature zone, and the Bruno, Calloway, Collins, Grenada, Loring, Memphis, and Waverly soils are taxadjuncts to the series because their mean annual soil temperature is slightly lower than the defined range for the series.

[3] Calloway and Grenada soils in this survey area are taxadjuncts to the series because they lack a well-expressed albic horizon tonguing into the argillic horizon that is defined for the series.

[4] Clifty soils in this survey area are taxadjuncts to the series because they have slightly less clay in the control section than is defined for the series.

[5] Lakin soils in this survey area are taxadjuncts to the series because they lack the well-expressed lamellae that are defined for the series.

[6] Sciotoville soils in this survey area are taxadjuncts to the series because they lack mottles of low chroma in the upper part of the argillic horizon that are defined for the series.

[7] Wheeling soils in this survey area are taxadjuncts to the series because they have a thinner solum than is defined for the series.

SERIES. The series consists of a group of soils that have formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineral and chemical composition.

Laboratory analysis

Soil classification, to a great extent, is based on the relationship between soil horizons and the specific soil characteristics that can be observed, inferred, or determined by close field examination. Physical, chemical, and mineralogical data resulting from laboratory analyses are useful to the soil scientist in correlating soil properties and in classifying soils. They support many field decisions.

Among the criteria in laboratory data that are useful in differentiating in some classes of the higher categories are particle-size distribution, base saturation, exchangeable sodium, bulk density, mineralogy, content of organic matter, and acidity. Some of these criteria are not differentiating in all classes of the higher categories, and all criteria were not reported in some of the published results of testing. Published results of laboratory testing that were used to help place the soils of Daviess and Hancock Counties in higher categories are discussed in the following paragraphs.

The Memphis, Loring, Grenada, and Calloway soils at sites selected in Jefferson (*28*), Marshall (*30*), Fulton (*11, 27*), Calloway (*11, 18, 30*), and Carlisle (*30*) Counties in Kentucky have been studied. Most of the data in publications for which literature citations are given for these series apply to soils of the same series in Daviess and Hancock Counties. Soils of these four series have formed in loess, and they comprise a drainage sequence.

At 15 of the 17 sites where soils of these four series were sampled for testing, the data confirmed the fine-silty classification of these soils in the current system. The Calloway soils of Fulton County, however, have less than 18 percent clay in the B2 horizon, above the fragipan. Therefore, they have been given a coarse-silty, rather than a fine-silty, classification. Unlike the Loring soils of Jefferson County, which show evidence of a bisequum profile, the Loring soils of Daviess and Hancock Counties lack such a profile. The Grenada and Calloway soils of Daviess and Hancock Counties, on the other hand, do have a bisequum profile, but published data do not confirm that soils of these same series in Jefferson County have a bisequum profile.

All the soils of these four series meet the base saturation requirements for Alfisols, except that the Memphis soils in Marshall and Jefferson Counties and one of the Calloway soils in Calloway County have low base saturation and are within the defined range of Ultisols. Because of differences in their base saturation, the Memphis soils in Fulton County are classified as Ultic Hapladalfs instead of Typic Hapladalfs, the classification of Memphis soils in Daviess and Hancock Counties, but they are near the defined boundary for the two subgroups.

The Wellston soils in Ohio and Grayson Counties (*10*), and the Zanesville soils in Grayson County, have formed in loess and in residuum of sandstone, siltstone, and shale. Data concerning these soils confirm their present classification in the higher categories, and they apply to Wellston and Zanesville soils in Daviess and Hancock Counties. The Wellston soils in Grayson County have more clay in the lower part of their profile, however, than typical for soils in the fine-silty family. In Grayson County they were correlated as a clayey subsoil variant of the Wellston series. During mapping, a few areas of a soil that has characteristics similar to those of this clayey subsoil variant were included with soils of the Wellston series in Daviess and Hancock Counties.

Data on two Wheeling soils were reported in Jefferson County (*28*). One of these soils is within the defined range of the fine-silty family, and it has other characteristics that are similar to those of Elk soils in Daviess and Hancock Counties. The other soil is classified as fine-loamy, as are the Wheeling soils of Daviess and Hancock Counties. The base saturation of this Wheeling soil in Jefferson County is lower than the defined range for Alfisols.

The Sequatchie soils in Henderson County (*29*) have a setting similar to that of Wheeling soils in Daviess and Hancock Counties. One Sequatchie soil in Henderson County is similar in texture to the Wheeling soils in Daviess and Hancock Counties. The other has less clay in the subsoil than the Wheeling soils, and it is in the coarse-loamy family. Both soils, as determined by ascertaining the base saturation of the lowest horizon that was sampled, appear to be Typic Hapladalfs instead of Ultic Hapladalfs, but they are near the defined boundary for the two subgroups. During mapping of soils in Daviess and Hancock Counties, areas of soils that are similar to the Sequatchie soils of Henderson County were included with the Wheeling soils.

Uniontown, Henshaw, and McGary soils of Henderson County (*29*) have properties that are similar to those of soils in the same series in Daviess and Hancock Counties. Published data concerning these soils in Henderson County support their classification in the higher categories of the current system shown for Daviess and Hancock Counties.

Patton soils in Fulton County (*27*) show evidence of illuviation in the distribution of clay and in the presence of clay films in their B horizon. Other properties of these soils agree with their current classification in Daviess and Hancock Counties.

Chemical properties of Karnak and Patton soils in Daviess and surrounding counties have been published (*9*). In the published data, soils originally reported as being in the Alligator and Dekoven series were later correlated in the Karnak and Patton series, respectively, in Daviess and Hancock Counties. The physical properties of these same soils, which were sampled at the same sites, have also been studied in the laboratory.[5] The chemical and physical data support the current classification of the soils of the Karnak and Patton series in the higher categories of the system, except that the content of organic matter in one profile of Karnak soils decreases regularly with increasing depth.

[5] RICE, HAROLD BELL. A COMPARISON OF CERTAIN PHYSICAL PROPERTIES OF IMPORTANT DEPRESSIONAL SOILS OF THE WESTERN KENTUCKY COAL FIELDS. 1963. [Unpublished master's thesis. Copy on file University of Kentucky.]

General Nature of the Area

This section provides general information about Daviess and Hancock Counties. It briefly describes geology, relief, and drainage; discusses natural resources and climate; and gives facts about farming and industry. The figures for population and the statistics on farming are from reports of the U.S. Bureau of the Census.

Daviess County was formed in 1815 from a part of Ohio County and included parts of what are now Hancock and McLean Counties. The first settlement in Daviess County, at the present site of Owensboro, was called Yellow Banks because of the color of the soils. After Owensboro replaced Yellow Banks, Owensboro became the county seat. Hancock County was formed in 1829 from parts of Ohio, Daviess, and Breckinridge Counties. Its county seat is Hawesville.

The first permanent settlers came into the area during the latter part of the eighteenth century. They were primarily farmers who cleared land, built cabins, and established farms. Their main crops were tobacco, corn, wheat, and grasses and legumes grown for hay and pasture. The principal kinds of livestock were cattle, hogs, chickens, sheep, horses, and mules.

Traders and merchants followed the early settlers into the area. Industries were developed to process and market the farm products and to provide the necessities of the frontier families. Since the early days, industry and manufacturing have increased in importance. The present economy is supported by both industry and farming.

The rural population increased during the nineteenth century, but it has tended to decrease in recent years as the population has shifted to urban areas. Several towns are in the survey area, but only Owensboro has had substantial growth. In Daviess County many residents of rural areas work in industries in Owensboro. The population of Daviess County was 79,486 in 1970, and the population of Hancock County was 7,080. Owensboro had a population of 50,329 in that year.

Geology, Relief, and Drainage

Daviess and Hancock Counties are in the Western Coal Field physiographic region. Except for a small area in the northeastern corner of Hancock County, where the surface rock is of Mississippian age, they are underlain at the surface by sedimentary rock of Pennsylvanian age.

The rock of Mississippian age consists of sandstone, siltstone, shale, and limestone of the Buffalo Wallow Formation, in the Upper Mississippian (*13*). The Caseyville, Carbondale, and Tradewater Formations of Lower and Middle Pennsylvanian age underlie the rest of Hancock County and the eastern part of Daviess County. The Lisman Formation of Upper Pennsylvanian age underlies the western part of Daviess County. Formations of Pennsylvanian age consist mostly of sandstone, siltstone, and shale.

A layer of loess, or windblown silt, covers the uplands throughout the survey area. This layer ranges from about 50 to about 2 feet or less in thickness. It is thickest in the northern part of Daviess County and is thinnest in the southern and eastern parts of Hancock County. In some steep areas, the layer of loess is thin or absent. Bedrock is exposed in a few places in the eastern part of Daviess County and in some places in Hancock County.

Alluvium covers most of the central and northwestern parts of Daviess County and is in the valleys in other parts of the survey area. The flood plains are covered by a deposit of alluvium that ranges from about 6 or 8 feet to about 100 to 200 feet in thickness. The alluvium is thickest in narrow valleys near the headwaters of streams in the wide valley of the Ohio River.

Soils of uplands in the survey area are undulating to hilly. The undulating soils mostly are on low hills in loess-covered areas adjacent to wide valleys that contain alluvium. In places the tops of the hills are less than 50 feet higher than the floors of the valleys. The most hilly topography is in the southeastern part of the survey area. Hills that have narrow tops and steep side slopes are in this area, and the valleys are also narrow. In the most dissected areas in the southern part of Hancock County, the distance from the tops of the ridges to the floors of the valleys is more than 200 feet.

Drainage in the survey area is mostly to the north and west. The Ohio River, which flows to the west, forms the northern boundary of these counties. Other streams flow to the north and west into the Ohio River. The Green River, a tributary of the Ohio River, forms a part of the western boundary of Daviess County. Panther Creek, which carries runoff from about 60 percent of Daviess County and from about 20 percent of Hancock County, drains into the Green River. Blackford Creek flows along part of the boundary between Daviess and Hancock Counties and carries runoff from about 28 percent of the survey area. Other small streams and ditches that supply drainage flow directly into the Ohio River.

Natural Resources

Petroleum, coal, sand, gravel, trees, and water are among the natural resources in Daviess and Hancock Counties. Oil is the most important revenue-producing mineral in this area, and several producing oilfields are in these two counties. Since 1920, when oil was discovered in this area, the cumulative production of this mineral has been about 50 million barrels. In 1967, 83 new wells were brought into production. The present rate of production is more than 1 million barrels annually. Oil has been produced in 63 oilfields in this area, some of which have now been abandoned.

Some wells that produce natural gas have been drilled in conjunction with drilling for oil. Gas is obtained from most oil wells, and gas has been produced commercially to some extent. Some homes are heated with gas from nearby oil wells, and some gas is released into the atmosphere. Six gasfields have been converted to storage fields and are used for storing gas needed during peak periods of use.

Coal is of sufficient quantity in both counties that it is mined in several locations and has been mined since before the Civil War. Shaft mining was the first procedure used for removing coal, and many shaft mines were small. In recent years mining has been by surface excavation. Several surface mines have operated in these

two counties in recent years, and two surface mines are now operating in Daviess County. One of these mines is near Panther in the southwestern part of the county, and the other is between Knottsville and the Hancock County line in the eastern part of Daviess County. About 4,600 acres had been surface mined in these two counties at the time this survey was made. The cumulative production of coal from all mines in these two counties has been about 25 million tons. More than 1 million tons of coal was mined in 1967.

Sand and gravel are mined from gravel beds or are taken from the Ohio River. In both counties deposits of gravel in several high terraces are suitable for use in construction of roads. The mined sand and gravel are also used for concrete construction and for industrial uses.

These counties contain deposits of fire clay, which generally lies beneath layers of coal. Fire clay is mined mostly in areas where the coal has already been removed. It is used for making pipe, brick, and ceramic tile. More clay is taken from Hancock County than from any other county in Kentucky. In 1969 more than 200,000 tons was removed. Slack water clay is used for making tile drains used in farm drainage.

In this general area, large areas of wet lowlands and of steep uplands are wooded. Most of the southern half of Hancock County and much of the southern and eastern parts of Daviess County are in trees.

The Ohio River provides an adequate supply of water for industrial use, recreation, and water transportation. Locks and dams insure enough depth to make the river navigable at all times. The river is increasingly used for boating, swimming, fishing, and water skiing.

Abundant water for most purposes is available in the river-deposited alluvium at a depth of about 30 feet. Wells in this area supply adequate water for irrigation and for industrial uses. The city of Owensboro obtains its supply of water from wells. In the past, water for home use in upland areas was supplied by wells or cisterns; now water is piped to many parts of the area. Ponds are used as a source of water for livestock, irrigation, fishing, and swimming. Several large lakes have been developed and now supply commercial recreational areas for swimming, fishing, and camping (fig. 21).

Climate [6]

Daviess and Hancock Counties have a temperate climate that is favorable for many kinds of plants and animals. Summers are generally warm and humid, and winters are moderately cold. Characteristic of all seasons are changes brought about by passing weather fronts and by the associated centers of high and low pressure. These fronts are least active late in spring and in summer. They become somewhat more active in fall and are most active in winter and early in spring. Tables 10 and 11 provide information about the climate of these two counties. Table 10, compiled from records kept in Owensboro, contains data on temperature and precipitation that are considered representative for this entire area. Table 11

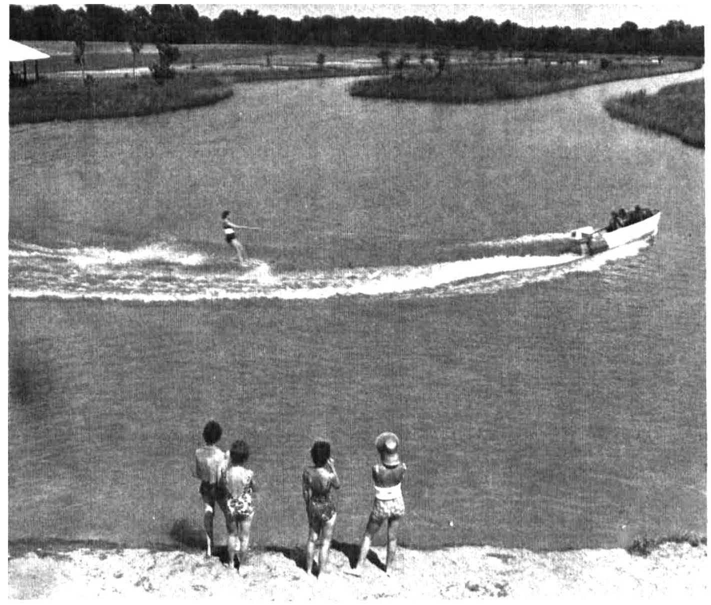


Figure 21.—**A commercial recreational area developed around a manmade lake. A canal dug to join two ponds provides water for skiing.**

indicates probabilities of the last freezing temperatures in spring and the first in fall.

Precipitation is usually fairly well distributed throughout the year. In most years, however, October is the month when the least precipitation is received, and March is the month when the most precipitation is received. During the period January to May, the soils are saturated part of the time. As a result, more runoff occurs, erosion is a more serious hazard, and flooding is more likely to occur than during the rest of the year.

The average annual rainfall is generally adequate for farm crops to be grown successfully, but droughty periods or periods of excessive rainfall (fig. 22) occur in some years. In June, for example, the average precipitation is 3.9 inches. Nevertheless, in about 1 year in 10, less than 1.0 inch of rainfall is received in June. Also during 1 year in 10, more than 7.8 inches of rainfall is received in June. Crop yields occasionally are reduced by dry spells or by excessive rainfall that can occur during the growing season.

Temperatures are generally highest in July and lowest in January. During July, day-to-day temperatures vary less than during other months of the year. They vary most in January.

Temperatures during the period of November to March are conducive to alternate freezing and thawing. Much of the time during that period, temperatures drop to below freezing at night and rise to above freezing during the day. On some days during this period, however, temperatures do not rise above freezing. On others they do not drop below freezing.

The length of the growing season varies from year to year and also according to the individual crop. For most native plants, the growing season begins in April and ends in October. The probable risk of frost damage to crops can be determined by referring to table 11.

[6] ALLEN B. ELAM, JR., climatologist for Kentucky, National Weather Service, U.S. Department of Commerce, assisted in preparing this section.

TABLE 10.—*Temperature and precipitation data*

[Data from records taken at Owensboro, Ky., 1931-60]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly maximum	Average monthly minimum	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with 1 inch or more of snow on ground	Average depth of snow on days with snow cover of 1 inch or more
	°F.	°F.	°F.	°F.	In.	In.	In.	No.	In.
January	45	27	64	5	4. 7	1. 1	9. 3	4	2
February	48	29	68	9	3. 4	1. 0	6. 5	2	3
March	56	35	75	17	4. 9	1. 8	8. 5	1	5
April	68	45	85	29	4. 0	2. 1	6. 3	0	0
May	78	54	90	40	4. 2	1. 4	8. 3	0	0
June	87	63	97	51	3. 9	1. 0	7. 8	0	0
July	90	67	98	56	3. 5	1. 3	5. 6	0	0
August	89	65	98	53	3. 5	1. 1	5. 9	0	0
September	83	57	95	42	3. 1	1. 0	5. 4	0	0
October	72	46	87	30	2. 4	1. 0	4. 3	0	0
November	57	35	77	17	3. 5	1. 2	6. 2	(1)	2
December	47	29	65	9	3. 3	1. 3	5. 4	2	3
Year	68	46	[2] 100	[3] −1	44. 4	32. 8	57. 8	9	3

[1] Less than ½ day.
[2] Average annual highest temperature.
[3] Average annual lowest temperature.

TABLE 11.—*Probabilities of the last freezing temperatures in spring and the first in fall*

[Based on temperature records taken 5 feet above ground at Owensboro, Ky.]

Probability	Dates for stated probability and temperature of—				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 17	March 23	April 2	April 13	April 28
2 years in 10 later than	March 9	March 16	March 27	April 7	April 23
5 years in 10 later than	February 23	March 4	March 15	March 27	April 13
Fall:					
1 year in 10 earlier than	November 23	November 13	October 30	October 19	October 6
2 years in 10 earlier than	November 28	November 19	November 5	October 25	October 11
5 years in 10 earlier than	December 8	November 29	November 15	November 3	October 21

As indicated in table 11, a temperature of 32° F. or lower can be expected after April 13 in spring and before October 21 in fall. Therefore, plants that are killed by a temperature of 32° have a growing season of about 190 days in a normal year.

Conditions are generally least favorable for outdoor activities in winter and early in spring. They are most favorable in summer and in fall. In some years planting is delayed in spring because the soils are too wet to work. Typical in fall are long periods of mild, sunny weather that is favorable for the harvesting of crops.

Farming

Much of the income in Daviess and Hancock Counties is derived from the sale of farm products. Farming is less important to the economy, however, than it formerly was. In Daviess County farming is still an important enterprise, even though it is not the major source of income. Until recently, the economy of Hancock County was largely based on farming, but now much of the income is derived from other sources. In 1969, 54 percent of the income derived from the sale of farm products in these two counties came from the sale of farm crops. About 46 percent came from the sale of livestock and livestock products.

Acreages of principal crops grown in 1969 in these two counties were as follows:

	Daviess County	Hancock County
Corn for all purposes	39, 538	3, 335
Soybeans for beans	38, 738	4, 122
Tobacco	3, 564	896
Wheat for grain	3, 999	711
Hay crops, excluding sorghum hay	13, 942	4, 753

Tobacco is the most important cash crop, but corn and soybeans are also important. In most years, however, about

Figure 22.—**Corn damaged by excess water that collected after a rain in summer.**

one-third of the corn crop is kept on the farm and is fed to livestock. Sorghum is not grown on a large acreage, but Hancock County is noted for its production of sorghum molasses. Lespedeza, alfalfa, clover, and timothy and other grasses are harvested extensively for hay. Figures for 1969 are not available for acreages in pasture; but pasture, excluding woods pastured, accounted for 66,033 acres in Daviess County and 18,553 acres in Hancock County in 1964.

In 1969 the principal kinds of livestock on farms in these two counties were as follows:

	Daviess County	*Hancock County*
Cattle and calves	37,269	10,126
Milk cows	2,972	165
Hogs and pigs	28,267	5,541
Sheep and lambs	197	37
Horses and ponies	902	395
Chickens 3 months old and older	187,097	32,180

Most livestock are raised for sale, but some are slaughtered on the farm to provide meat for home use.

In recent years the general trend has been for the size of farms to increase and the number of farms to decrease. Large farm machinery makes large farms more economical to operate than small farms. Therefore, many small farms are being combined into larger units. Because level or nearly level soils are better suited to use of mechanized equipment than are steep soils, some small farms that contain mostly hilly soils have been abandoned. In 1969 Daviess County had a total of 1,971 farms and Hancock County had a total of 715 farms. In that year the average size of all farms in Daviess County was 127 acres. The average size of all farms in Hancock County was 118 acres.

Part-time farming is on the increase in these two counties, for many people who live in the country work in the city. In 1969, a total of 1,125 operators of farms had employment away from the farm for 200 days or more.

Industry

Owensboro began developing as an industrial center about the middle of the nineteenth century. Since that time, it has continued to attract new industry. In recent years, industry has become highly important to the economy of the area.

Many more people in the survey area are employed in manufacturing and in trades and services than are employed in farming. According to the Owensboro-Daviess County Chamber of Commerce, about 10,000 workers were employed in manufacturing, about 8,000 were employed in trades and services, and about 2,000 were employed in farming at the time this survey was made. Among the items manufactured are electronic components, tobacco products, furniture, whisky, food products, and aluminum products and other products from metal.

During the last few years, manufacturers of aluminum products and of paper products have moved into the northern part of Hancock County. An electric generating plant near the Ohio River in Hancock County has helped to bring about a change in this area from farming to industrial enterprises.

Industries outside the survey area provide employment for residents of these two counties. Among those that provide employment to residents of Daviess and Hancock Counties are ones located in Henderson, Ky., and in Evansville and Tell City, Ind.

Literature Cited

(1) Allan, P. F., Garland, L. E., and Dugan, R. F.
1963. Rating northeastern soils for their suitability for wildlife habitat. 28th N. Amer. Wildlife and Nat. Resources Conf. Wildlife Management Institute, pp. 247–261, illus.

(2) American Association of State Highway Officials.
1961. Standard specifications for highway materials and methods of sampling and testing. Ed. 8, 2 v., illus. Washington, D.C.

(3) Baldwin, Mark, Kellogg, Charles E., and Thorp, James.
1938. Soil classification. U.S. Dept. Agr. Ybk., pp. 979–1001, illus.

(4) Beck, Donald E.
1962. Yellow-poplar site index curves. U.S. Dept. Agr. Southeastern Forest Expt. Sta., Res. Note 180, 2 pp., illus.

(5) Broadfoot, W. M.
1960. Field guide for evaluating cottonwood sites. U.S. Dept. Agr., Southern Forest Expt. Sta. Occasional Paper 178, 6 pp., illus.

(6) ——— and Krinard, R. M.
1959. Guide for evaluating sweetgum sites. U.S. Dept. Agr., Southern Expt. Sta. Occasional Paper 176, 8 pp., illus.

(7) Cline, Marlin G.
1949. Basic principles of soil classification. Soil Sci. 67: 81–91.

(8) Coile, T. S., and Schumacher, F. X.
1953. Site index of young stands of loblolly and shortleaf pines in the piedmont plateau region. Jour. Forestry 51: 432–435.

(9) Cox, Frank R., Jr., and Hutchinson, T. B., Jr.
1961. Morphological and chemical properties of important depressional soils of lowlands in the western coal field region, Kentucky. Soil Sci. Soc. Amer. Proc. 25: 236–239.

(10) HUTCHESON, T. B., JR., and BAILEY, H. H.
1965. EFFECT OF UNDERLYING RESIDUA ON CHEMICAL AND MINERALOGICAL PROPERTIES OF SOILS DEVELOPED IN A UNIFOM LOESS OVERLAY. Soil Sci. Soc. Amer. Proc. 29: 427–432.

(11) ——— and LEWIS, R. J., and SEAY, W. A.
1959. CHEMICAL AND CLAY MINERALOGICAL PROPERTIES OF CERTAIN MEMPHIS CATENA SOILS OF WESTERN KENTUCKY. Soil Sci. Soc. Amer. Proc. 23: 474–478.

(12) MCCARTHY, E. F.
1933. YELLOW-POPULAR CHARACTERISTICS, GROWTH, AND MANAGEMENT. U.S. Dept. Agr. Tech. Bul. 356, 58 pp., illus.

(13) MCFARLAN, A. C.
1943. GEOLOGY OF KENTUCKY. 531 pp., illus. Univ. Ky., Lexington, Ky.

(14) NELSON, T. C., CLUTTER, J. L., and CHAIKEN, L. E.
1961. YIELD OF VIRGINIA PINE. U.S. Dept. Agr. Southeastern Forest Expt. Sta., Sta. Paper 124.

(15) PORTLAND CEMENT ASSOCIATION.
1962. PCA SOIL PRIMER. 52 pp., illus.

(16) PUTMAN, JOHN A., FURNIVAL, G. M., and MCKNIGHT, J. S.
1960. MANAGEMENT AND INVENTORY OF SOUTHERN HARDWOODS. U.S. Dept. Agr. Handb. No. 181, 102 pp., illus.

(17) RAY, LOUIS L.
1965. GEOMORPHOLOGY AND QUATERNARY GEOLOGY OF THE OWENSBORO QUADRANGLE, INDIANA AND KENTUCKY. Geol. Survey Prof. Paper 488, 72 pp., illus.

(18) REGIONAL RESEARCH PROJECT S-14 TECHNICAL COMMITTEE.
1959. CERTAIN PROPERTIES OF SELECTED SOUTHEASTERN UNITED STATES SOILS AND MINERALOGICAL PROCEDURES FOR THEIR STUDY. Southern Coop. Series Bul. 61, 146 pp.

(19) RUHE, R. V., and SCHOLTES, W. H.
1956. AGES AND DEVELOPMENT OF SOIL LANDSCAPES IN RELATION TO CLIMATIC AND VEGETATIONAL CHANGES IN IOWA. Soil Sci. Soc. Amer. Proc. No. 2, 20: 264–273, illus.

(20) SCHNUR, G. LUTHER.
1937. YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS. U.S. Dept. Agr. Tech. Bul. 560, 88 pp., illus. [Reprinted 1961]

(21) SCHUMACHER, F. X., and COILE, T. S.
1960. GROWTH AND YIELDS OF NATURAL STANDS OF THE SOUTHERN PINES. 115 pp. T. S. Coile, Inc., Durham, N.C.

(22) SIMONSON, ROY W.
1962. SOIL CLASSIFICATION IN THE UNITED STATES. Sci. 137: 1027–1034.

(23) THORNBURY, WILLIAM D.
1950. GLACIAL SLUICEWAYS AND LACUSTRINE PLAINS OF SOUTHERN INDIANA. Indiana Dept. Conserv., Div. of Geol., Bul. 4, 21 pp., illus.

(24) THORP, JAMES, and SMITH, GUY D.
1949. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUPS. Soil Sci. 67: 117–126.

(25) UNITED STATES DEPARTMENT OF AGRICULTURE.
1951. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handb. 18, 503 pp., illus. [Supplement issued in 1962]

(26) ———
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. Soil Survey Staff, Soil Cons. Serv., 265 pp., illus. [Supplements issued in March 1967 and September 1968]

(27) ———
1964. SOIL SURVEY OF FULTON COUNTY, KENTUCKY. U.S. Dept. Agr., Soil Cons. Serv. in coop. with Ky. Agr. Expt. Sta. 72 pp., illus.

(28) ———
1966. SOIL SURVEY OF JEFFERSON COUNTY, KENTUCKY. U.S. Dept. Agr., Soil Cons. Serv. in coop. with Ky. Agr. Expt. Sta. 137 pp., illus.

(29) ———
1967. SOIL SURVEY OF HENDERSON COUNTY, KENTUCKY. U.S. Dept. Agr., Soil Cons. Serv. in coop. with Ky. Agr. Expt. Sta. 108 pp., illus

(30) ———
1967. SOIL SURVEY LABORATORY DATA AND DESCRIPTIONS FOR SOME SOILS OF KENTUCKY. U.S. Dept. Agr. Soil Cons. Serv. in coop. with Ky. Agr. Expt. Sta. Soil Survey Investigations Rept. No. 14, 137 pp.

(31) UNITED STATES DEPARTMENT OF DEFENSE.
1968. UNIFIED SOIL CLASSIFICATION SYSTEM FOR ROADS, AIRFIELDS, EMBANKMENTS, AND FOUNDATIONS. MIL–STD–619B, 30 pp., illus.

Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Bedding. Plowing, grading, or otherwise elevating the surface of a flat field into a series of broad beds, or "lands," so as to leave shallow surface drains between the beds.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Depth, soil. In this survey depth refers to the depth from the surface of the soil to bedrock or other nonsoil material. The depth classes are (1) *deep*, more than 40 inches; (2) *moderately deep*, 20 to 40 inches; and (3) *shallow*, less than 20 inches.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Gravelly. Of a soil containing fragments less than 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural fertility. The natural ability of a soil to provide compounds needed to produce crops and pasture without application of fertilizer. Relative terms used in this soil survey are: *very high, high, moderate, moderately low,* and *low.*

Organic matter. Relative terms used in this soil survey to express content of organic matter are: *high, medium, low,* and *very low.*

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Residual material. Unconsolidated, partly weathered material that accumulates over disintegrating solid rock. Residual material is not soil, but is frequently the material in which soil is formed.

Root zone, depth. The depth classes are (1) *deep,* more than 30 inches; (2) *moderately deep,* 20 to 30 inches; and (3) *shallow,* less than 20 inches.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. If two sequa are present in a single soil profile, it is said to have a bisequum.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope, soil. The slope classes in this soil survey are: 0 to 2 percent—nearly level, 2 to 6 percent—gently sloping, 6 to 12 percent—sloping, 12 to 20 percent—strongly sloping, 20 to 30 percent—moderately steep, over 30 percent—steep.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formations are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

Nondiscrimination Statement

Nondiscrimination Policy

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for

program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).

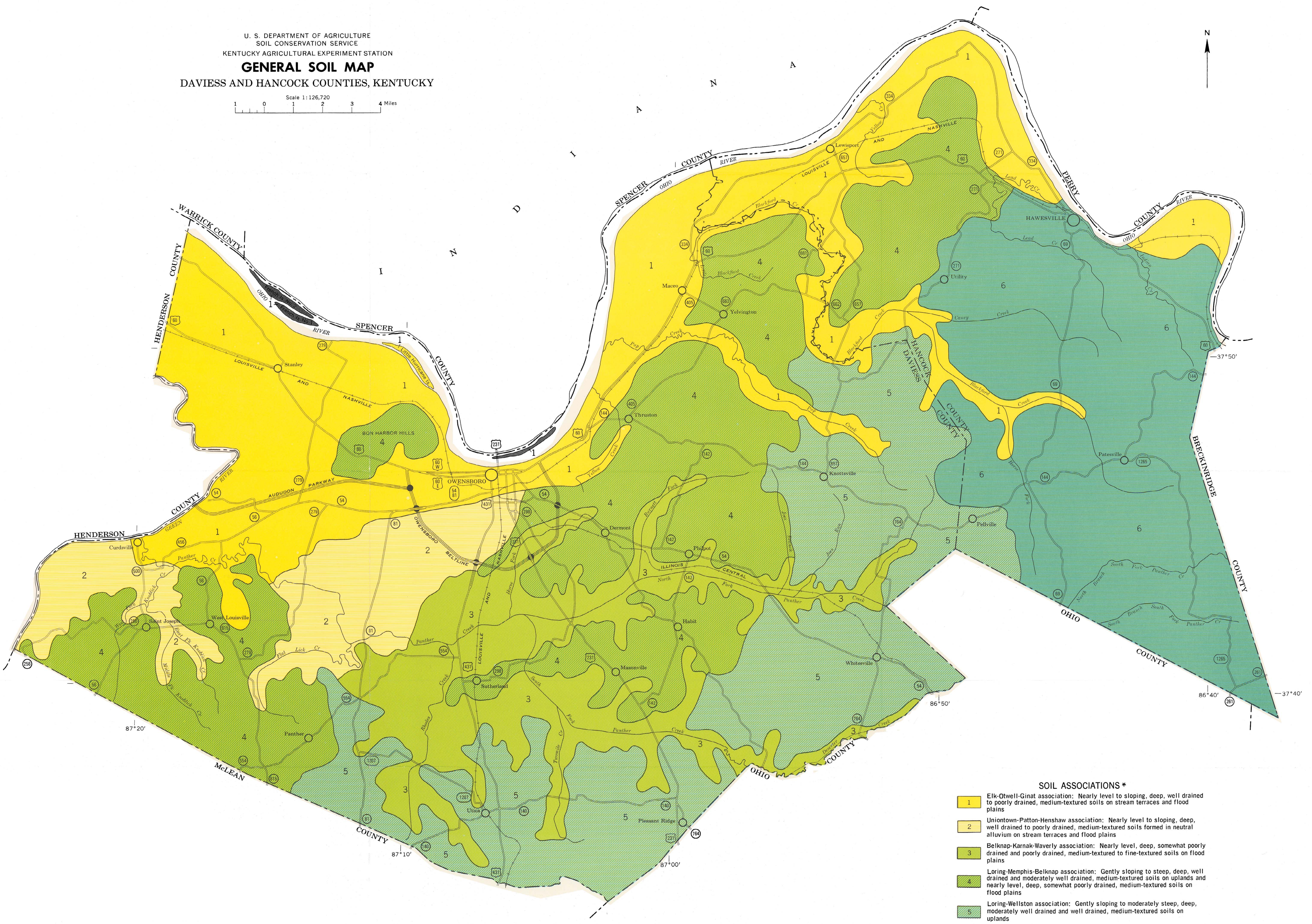
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENTUCKY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

DAVIESS AND HANCOCK COUNTIES, KENTUCKY

Scale 1:126,720

1 0 1 2 3 4 Miles



SOIL ASSOCIATIONS*

1	Elk-Otwell-Ginat association: Nearly level to sloping, deep, well drained to poorly drained, medium-textured soils on stream terraces and flood plains
2	Uniontown-Patton-Henshaw association: Nearly level to sloping, deep, well drained to poorly drained, medium-textured soils formed in neutral alluvium on stream terraces and flood plains
3	Belknap-Karnak-Waverly association: Nearly level, deep, somewhat poorly drained and poorly drained, medium-textured to fine-textured soils on flood plains
4	Loring-Memphis-Belknap association: Gently sloping to steep, deep, well drained and moderately well drained, medium-textured soils on uplands and nearly level, deep, somewhat poorly drained, medium-textured soils on flood plains
5	Loring-Wellston association: Gently sloping to moderately steep, deep, moderately well drained and well drained, medium-textured soils on uplands
6	Wellston-Frondorf-Zanesville association: Gently sloping to steep, well drained and moderately well drained, deep and moderately deep, medium-textured soils on uplands

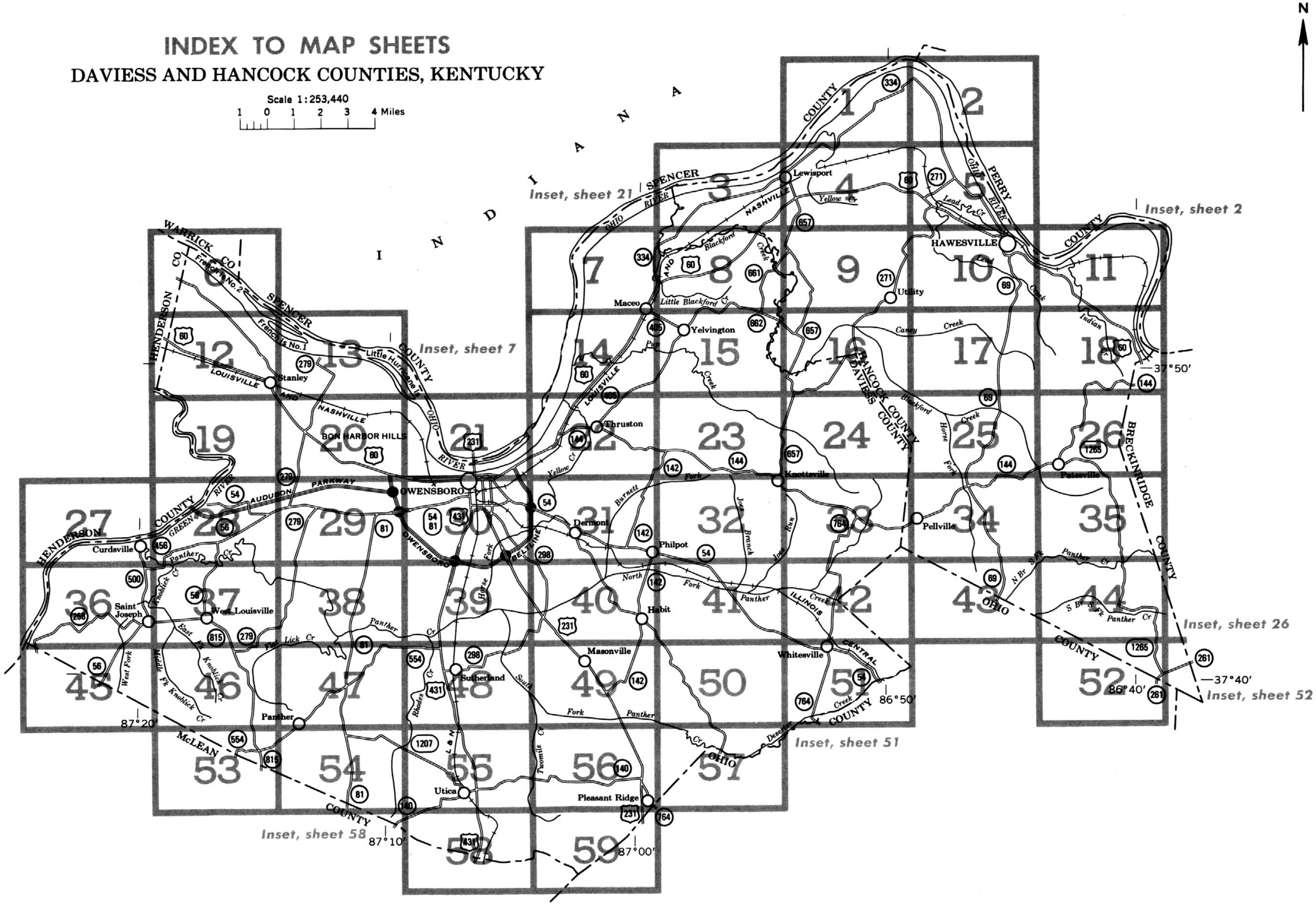
* Texture refers to surface layer of the major soils in each association.

Compiled 1972

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

DAVIESS AND HANCOCK COUNTIES, KENTUCKY



GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which it belongs. A technical description of a profile that is representative of the series is described under the series. Management of the soils for farming is described in the section "Use of Soils for Crops and Pasture." Other information is given in tables as follows:

Acreage and extent of soils, table 1, p. 8.
Estimated yields, table 2, p. 55.
Soil interpretations for woodland, table 3, p. 58.
Suitability of soils for wildlife, table 4, p. 64.
Engineering uses of soils, tables 5, 6, and 7, pp. 66 to 81.
Interpretations for town and country planning, table 8, p. 84.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Symbol	Page
AlF	Alluvial land, steep	7	VIIe-3	53	3s1	60
As	Ashton silt loam	9	I-3	47	1o1	58
Be	Belknap silt loam	10	IIw-1	48	1w1	58
Bu	Bruno loamy fine sand	11	IIIs-1	51	3s1	60
Ca	Calloway silt loam	11	IIIw-3	51	1w1	58
Cg	Clifty gravelly loam	12	IIs-1	48	1o1	58
Co	Collins silt loam	13	I-2	47	1w1	58
EkA	Elk silt loam, 0 to 2 percent slopes	13	I-3	47	2o1	58
EkB	Elk silt loam, 2 to 6 percent slopes	13	IIe-1	47	2o1	58
EkC	Elk silt loam, 6 to 12 percent slopes	14	IIIe-1	49	2o1	58
EkE	Elk silt loam, 12 to 50 percent slopes	14	VIe-1	52	2o1	58
ElC3	Elk silty clay loam, 6 to 12 percent slopes, severely eroded	14	IVe-3	52	3o1	58
FwD	Frondorf-Wellston silt loams, 12 to 20 percent slopes	15	IVe-2	51	3o1	58
FwD3	Frondorf-Wellston silt loams, 12 to 20 percent slopes, severely eroded	15	VIe-3	52	4o1	60
FwE	Frondorf-Wellston silt loams, 20 to 30 percent slopes	15	VIe-2	52	3r1 (Northerly aspects)	60
					4r1 (Southerly aspects)	60
FwE3	Frondorf-Wellston silt loams, 20 to 30 percent slopes, severely eroded	15	VIIe-2	53	4r1	60
FwF	Frondorf-Wellston silt loams, 30 to 50 percent slopes	16	VIIe-1	53	3r1 (Northerly aspects)	60
					4r1 (Southerly aspects)	60
Gn	Ginat silt loam	16	IIIw-3	51	1w2	58
GrA	Grenada silt loam, 0 to 2 percent slopes	17	IIw-2	48	3o1	58
GrB	Grenada silt loam, 2 to 6 percent slopes	18	IIe-2	47	3o1	58
Gu	Gullied land	18	VIIe-2	53	--------------	--
He	Henshaw silt loam	19	IIw-3	48	1w1	58
Hu	Huntington silt loam	19	I-1	46	1o1	58
Ja	Jacob silty clay loam	20	IIIw-1	50	1w2	58
Ka	Karnak silt loam, overwash	20	IIIw-4	51	1w2	58
Kc	Karnak silty clay	21	IIIw-4	51	1w2	58
LaA	Lakin loamy fine sand, 0 to 2 percent slopes	22	IIIs-1	51	3s1	60
Ld	Lindside silt loam	23	I-2	47	1w1	58
LoA	Loring silt loam, 0 to 2 percent slopes	24	I-3	47	3o1	58
LoB	Loring silt loam, 2 to 6 percent slopes	24	IIe-3	48	3o1	58
LoC	Loring silt loam, 6 to 12 percent slopes	24	IIIe-2	49	3o1	58
LoD	Loring silt loam, 12 to 25 percent slopes	24	VIe-1	52	3o1	58
LrC3	Loring silty clay loam, 6 to 12 percent slopes, severely eroded	25	IVe-4	52	4o1	60
LrD3	Loring silty clay loam, 12 to 25 percent slopes, severely eroded	25	VIe-3	52	4o1	60
Mc	McGary silt loam	26	IIIw-2	51	3w1	60
MdA	Markland silt loam, 0 to 2 percent slopes	27	IIs-2	48	2c1	58
MdE	Markland silt loam, 12 to 30 percent slopes	27	VIe-1	52	2c1	58
MeB2	Markland silty clay loam, 2 to 6 percent slopes, eroded	27	IIIe-1	49	2c1	58
MfC3	Markland silty clay, 6 to 12 percent slopes, severely eroded	27	VIe-3	52	3c1	60
MfE3	Markland silty clay, 12 to 30 percent slopes, severely eroded	28	VIIe-2	53	3c1	60
Mh	Melvin silt loam	29	IIIw-1	50	1w2	58
MmA	Memphis silt loam, 0 to 2 percent slopes	29	I-3	47	2o1	58
MmB	Memphis silt loam, 2 to 6 percent slopes	30	IIe-1	47	2o1	58
MmC	Memphis silt loam, 6 to 12 percent slopes	30	IIIe-1	49	2o1	58
MmE	Memphis silt loam, 12 to 30 percent slopes	30	VIe-1	52	2o1	58
MmF	Memphis silt loam, 30 to 60 percent slopes	30	VIIe-1	53	2o1	58
MnC3	Memphis silty clay loam, 6 to 12 percent slopes, severely eroded	30	IVe-3	52	3o1	58
MnE3	Memphis silty clay loam, 12 to 30 percent slopes, severely eroded	30	VIe-3	52	3o1	58
Mo	Montgomery silty clay loam	32	IIIw-4	51	1w2	58
Ne	Newark silt loam	32	IIw-1	48	1w1	58
OtA	Otwell silt loam, 0 to 2 percent slopes	33	IIw-2	48	3o1	58
OtB	Otwell silt loam, 2 to 6 percent slopes	33	IIe-2	47	3o1	58
Pa	Patton silt loam	34	IIw-1	48	1w2	58
Ph	Patton silt loam, overwash	34	IIw-1	48	1w2	58
ScA	Sciotoville loam, 0 to 2 percent slopes	35	IIw-2	48	3o1	58
ShC	Shelocta silt loam, 6 to 12 percent slopes	36	IIIe-1	49	2o1	58
ShD	Shelocta silt loam, 12 to 25 percent slopes	36	IVe-1	51	2o1	58
St	Strip mine spoil	36	VIIs-1	53	--------------	--
UnA	Uniontown silt loam, 0 to 2 percent slopes	37	I-3	47	2o1	58
UnB	Uniontown silt loam, 2 to 6 percent slopes	37	IIe-1	47	2o1	58
UoC3	Uniontown silty clay loam, 6 to 12 percent slopes, severely eroded	37	IVe-3	52	3o1	58
Ur	Urban land	38	------	--	--------------	--
Wa	Wakeland silt loam	38	IIw-1	48	1w1	58
We	Waverly silt loam	39	IIIw-1	50	1w2	58
Wh	Weinbach silt loam	40	IIIw-3	51	1w1	58
WlC	Wellston silt loam, 6 to 12 percent slopes	40	IIIe-1	49	2o1	58
WlC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded	41	IVe-3	52	3o1	58
WlD	Wellston silt loam, 12 to 20 percent slopes	41	IVe-1	51	2o1	58
WlE	Wellston silt loam, 20 to 30 percent slopes	42	VIe-1	52	2o1	58
WlE3	Wellston silt loam, 12 to 30 percent slopes, severely eroded	42	VIe-3	52	3o1	58
WnA	Wheeling loam, 0 to 2 percent slopes	42	I-3	47	2o1	58
WnB	Wheeling loam, 2 to 6 percent slopes	43	IIe-1	47	2o1	58
WnC	Wheeling loam, 6 to 12 percent slopes	43	IIIe-1	49	2o1	58
Wu	Wilbur silt loam	43	I-2	47	1w1	58
ZaB	Zanesville silt loam, 2 to 6 percent slopes	44	IIe-3	48	3o1	58
ZaC	Zanesville silt loam, 6 to 12 percent slopes	44	IIIe-2	49	3o1	58
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	45	IVe-4	52	4o1	60

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Canal lock

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2 or 3, in a symbol indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
AlF	Alluvial land, steep
As	Ashton silt loam
Be	Belknap silt loam
Bu	Bruno loamy fine sand
Ca	Calloway silt loam
Cg	Clifty gravelly loam
Co	Collins silt loam
EkA	Elk silt loam, 0 to 2 percent slopes
EkB	Elk silt loam, 2 to 6 percent slopes
EkC	Elk silt loam, 6 to 12 percent slopes
EkE	Elk silt loam, 12 to 50 percent slopes
ElC3	Elk silty clay loam, 6 to 12 percent slopes, severely eroded
FwD	Frondorf-Wellston silt loams, 12 to 20 percent slopes
FwD3	Frondorf-Wellston silt loams, 12 to 20 percent slopes, severely eroded
FwE	Frondorf-Wellston silt loams, 20 to 30 percent slopes
FwE3	Frondorf-Wellston silt loams, 20 to 30 percent slopes, severely eroded
FwF	Frondorf-Wellston silt loams, 30 to 50 percent slopes
Gn	Ginat silt loam
GrA	Grenada silt loam, 0 to 2 percent slopes
GrB	Grenada silt loam, 2 to 6 percent slopes
Gu	Gullied land
He	Henshaw silt loam
Hu	Huntington silt loam
Ja	Jacob silty clay loam
Ka	Karnak silt loam, overwash
Kc	Karnak silty clay
LaA	Lakin loamy fine sand, 0 to 2 percent slopes
Ld	Lindside silt loam
LoA	Loring silt loam, 0 to 2 percent slopes
LoB	Loring silt loam, 2 to 6 percent slopes
LoC	Loring silt loam, 6 to 12 percent slopes
LoD	Loring silt loam, 12 to 25 percent slopes
LrC3	Loring silty clay loam, 6 to 12 percent slopes, severely eroded
LrD3	Loring silty clay loam, 12 to 25 percent slopes, severely eroded
Mc	McGary silt loam
MdA	Markland silt loam, 0 to 2 percent slopes
MdE	Markland silt loam, 12 to 30 percent slopes
MeB2	Markland silty clay loam, 2 to 6 percent slopes, eroded

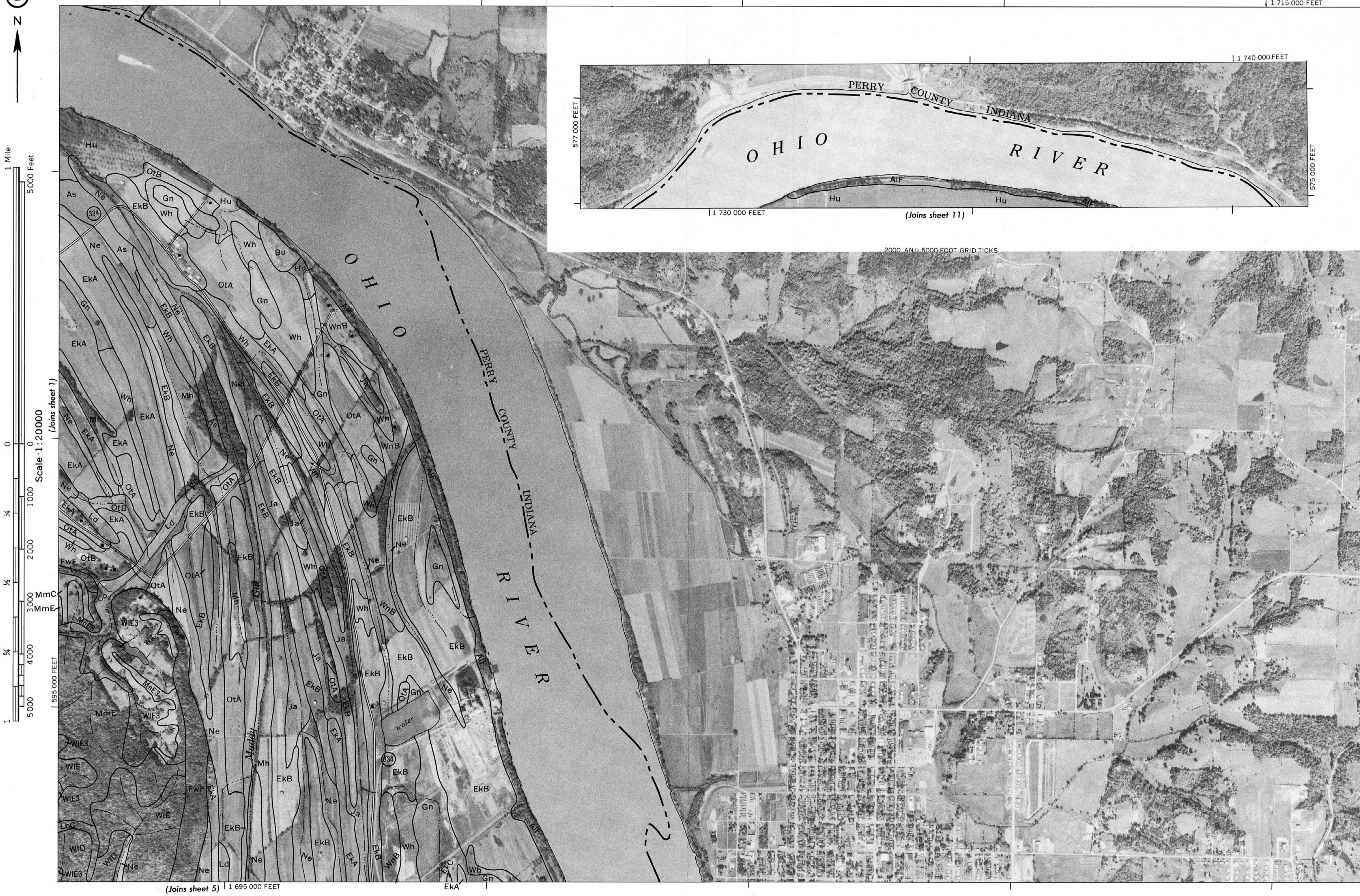
SYMBOL	NAME
MfC3	Markland silty clay, 6 to 12 percent slopes, severely eroded
MfE3	Markland silty clay, 12 to 30 percent slopes, severely eroded
Mh	Melvin silt loam
MmA	Memphis silt loam, 0 to 2 percent slopes
MmB	Memphis silt loam, 2 to 6 percent slopes
MmC	Memphis silt loam, 6 to 12 percent slopes
MmE	Memphis silt loam, 12 to 30 percent slopes
MmF	Memphis silt loam, 30 to 60 percent slopes
MnC3	Memphis silty clay loam, 6 to 12 percent slopes, severely eroded
MnE3	Memphis silty clay loam, 12 to 30 percent slopes, severely eroded
Mo	Montgomery silty clay loam
Ne	Newark silt loam
OtA	Otwell silt loam, 0 to 2 percent slopes
OtB	Otwell silt loam, 2 to 6 percent slopes
Pa	Patton silt loam
Ph	Patton silt loam, overwash
ScA	Sciotoville loam, 0 to 2 percent slopes
ShC	Shelocta silt loam, 6 to 12 percent slopes
ShD	Shelocta silt loam, 12 to 25 percent slopes
St	Strip mine spoil
UnA	Uniontown silt loam, 0 to 2 percent slopes
UnB	Uniontown silt loam, 2 to 6 percent slopes
UoC3	Uniontown silty clay loam, 6 to 12 percent slopes, severely eroded
Ur	Urban land
Wa	Wakeland silt loam
We	Waverly silt loam
Wh	Weinbach silt loam
WlC	Wellston silt loam, 6 to 12 percent slopes
WlC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded
WlD	Wellston silt loam, 12 to 20 percent slopes
WlE	Wellston silt loam, 20 to 30 percent slopes
WlE3	Wellston silt loam, 12 to 30 percent slopes, severely eroded
WnA	Wheeling loam, 0 to 2 percent slopes
WnB	Wheeling loam, 2 to 6 percent slopes
WnC	Wheeling loam, 6 to 12 percent slopes
Wu	Wilbur silt loam
ZaB	Zanesville silt loam, 2 to 6 percent slopes
ZaC	Zanesville silt loam, 6 to 12 percent slopes
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 1

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 2



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 2

3

N

1 Mile
5000 Feet
Scale 1:20000

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 3

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 4

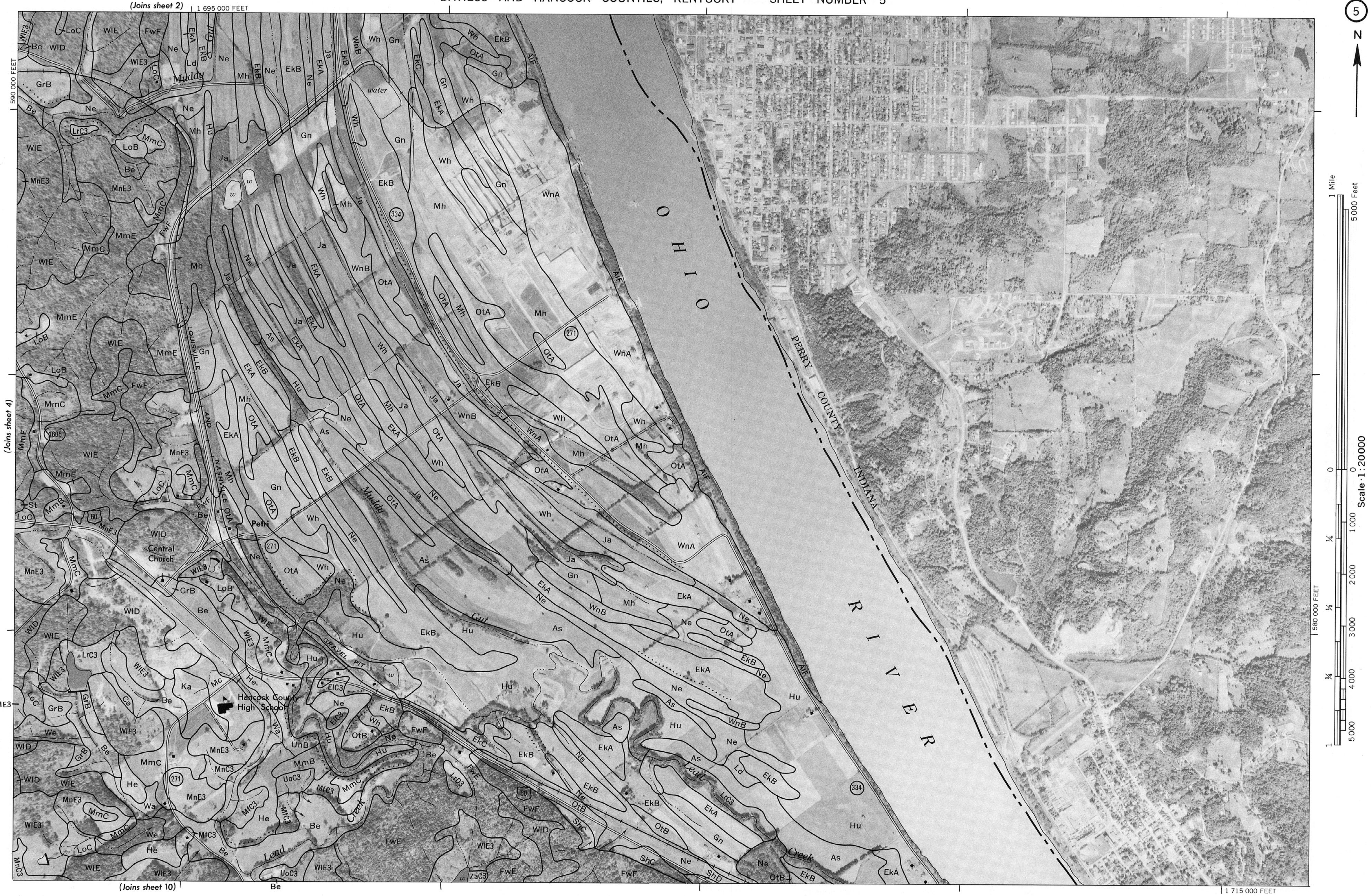
N

1 Mile
5 000 Feet
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

Scale 1:20000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



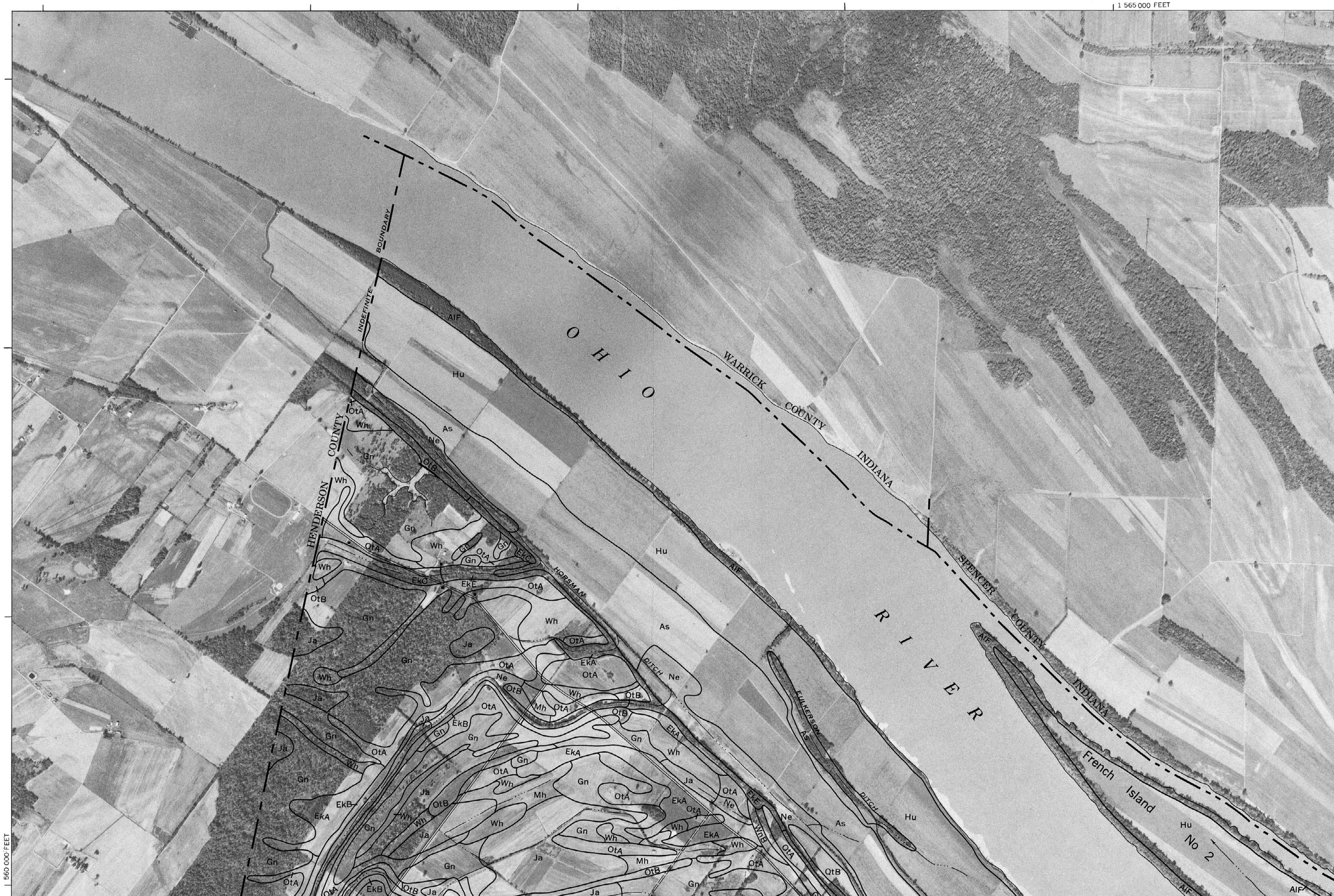
DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 5

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

6

N

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 6



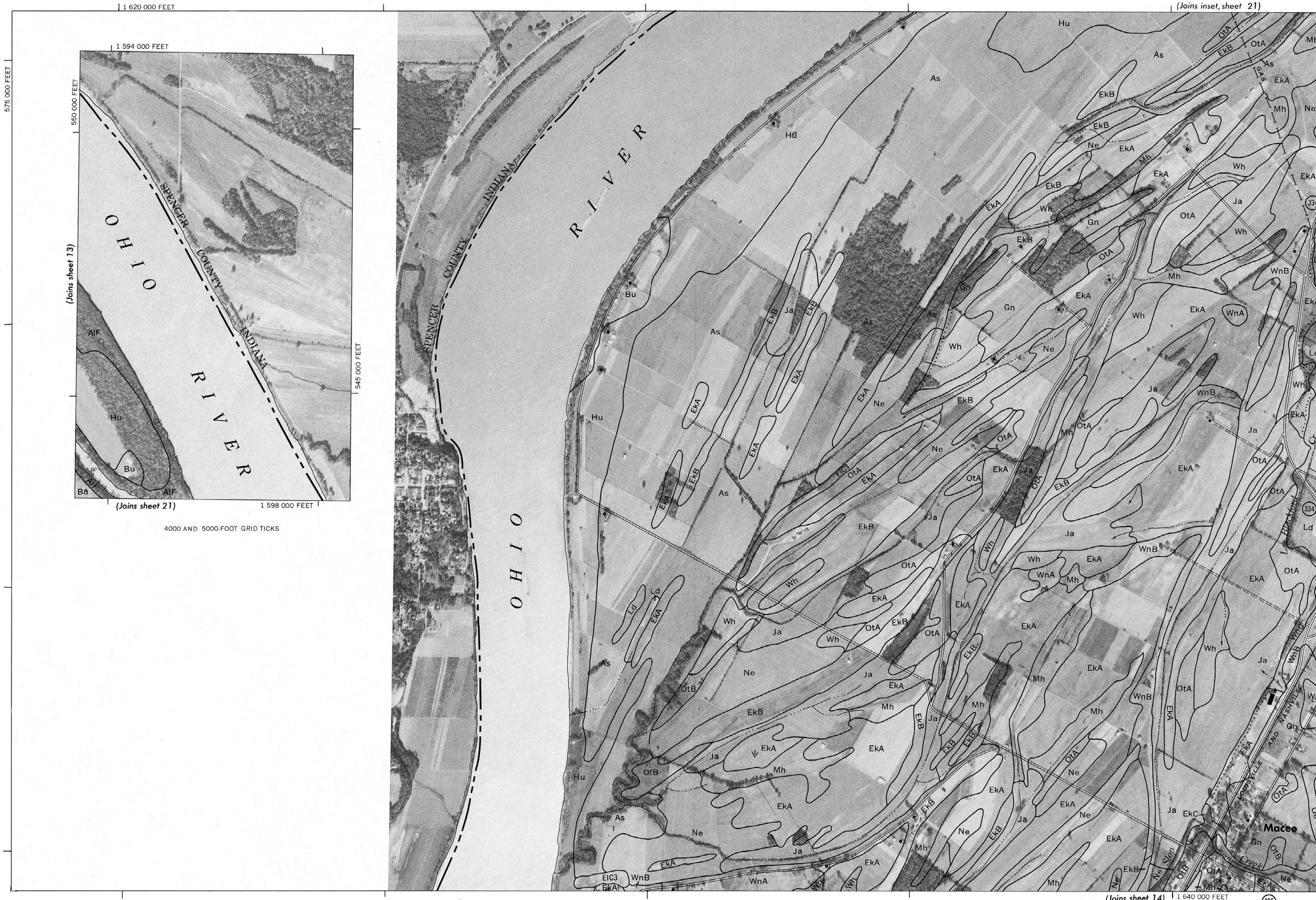
1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000
Scale 1:20000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 6

7

N



1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

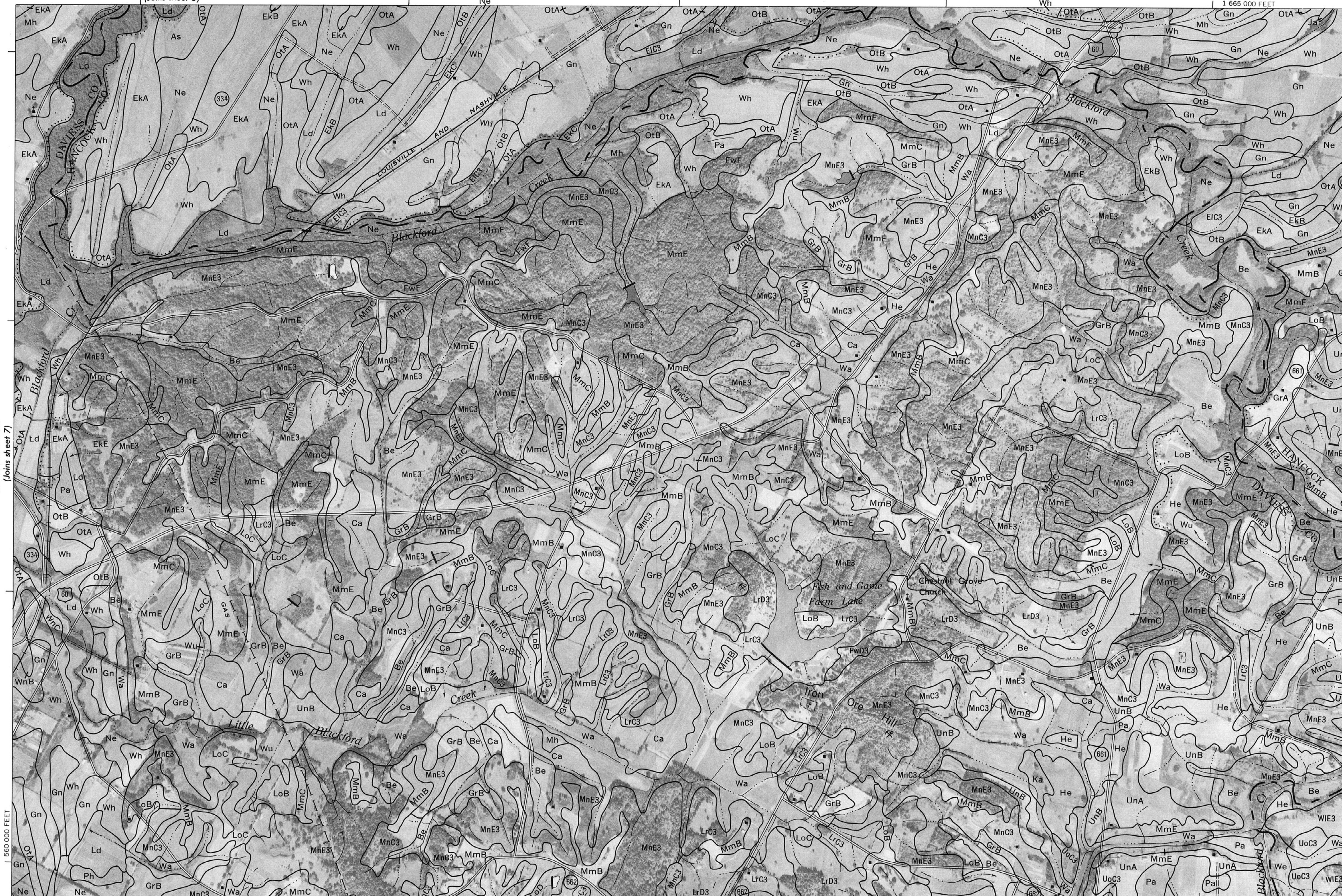
DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 7

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 8

N

(Joins sheet 3)



(Joins sheet 7)

(Joins sheet 9)

(Joins sheet 15)

1 Mile

5000 Feet

Scale 1:20000

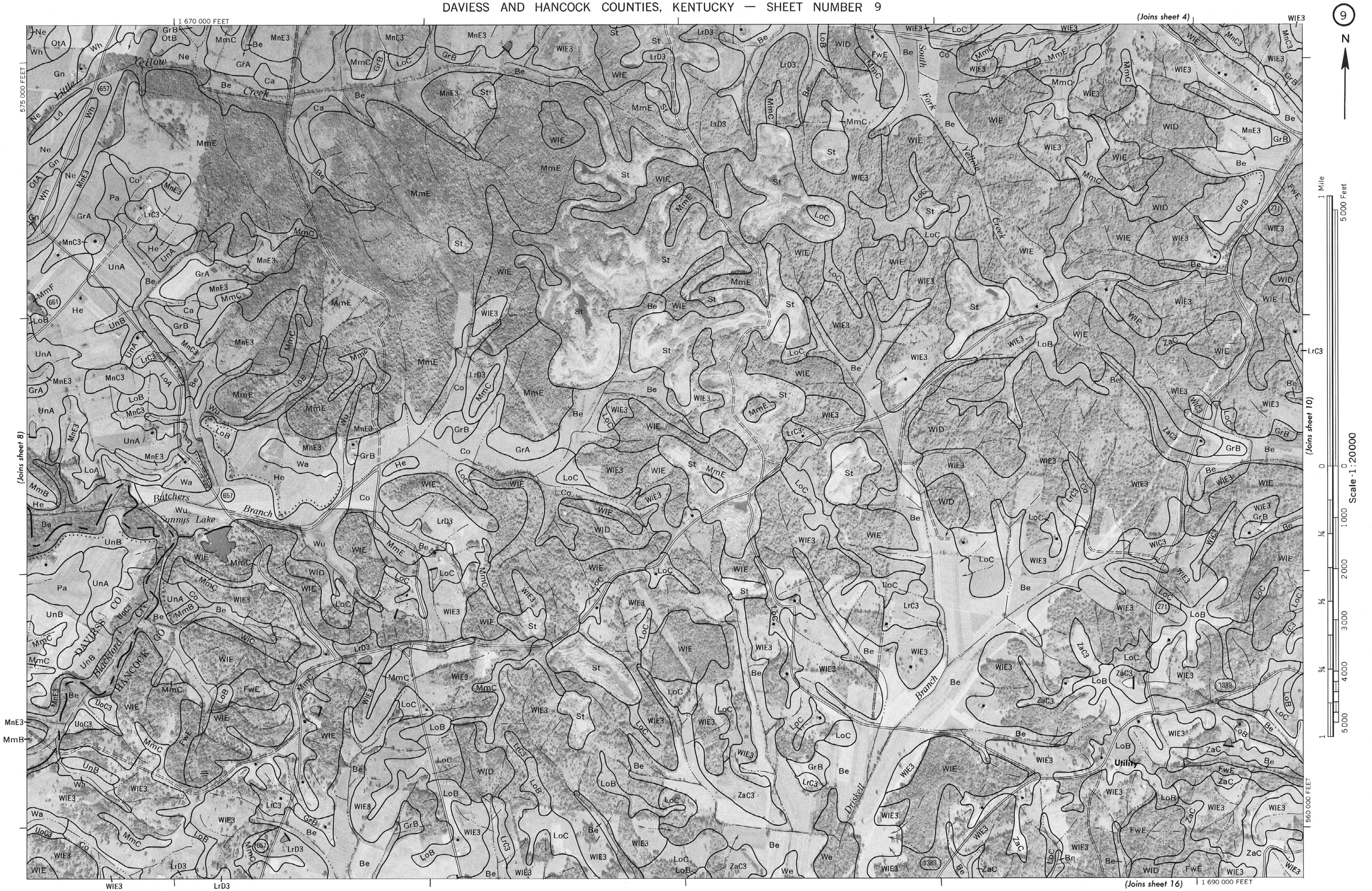
0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

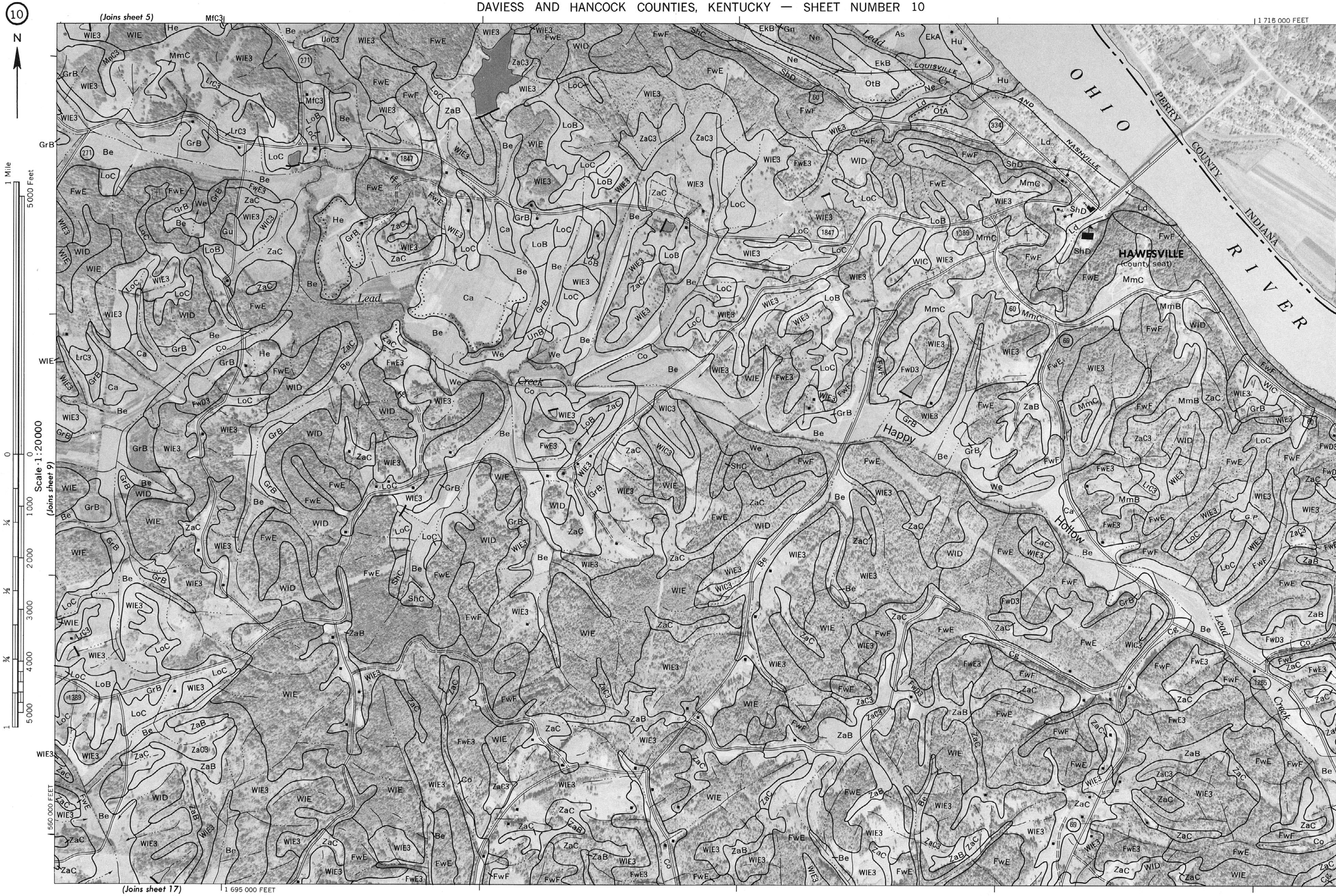
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 8



DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 9

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.



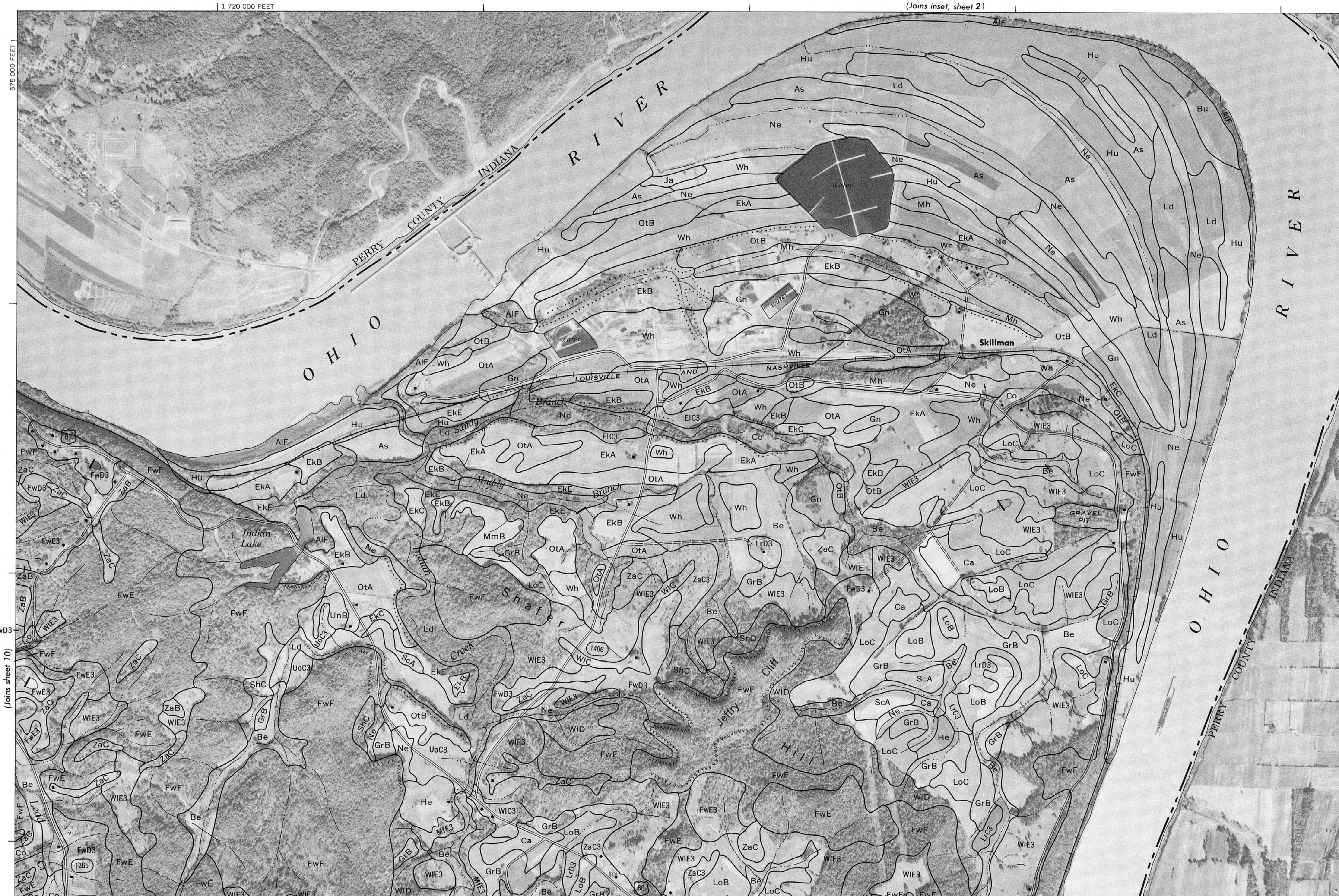
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

1 720 000 FEET

(Joins inset, sheet 2)

575 000 FEET

(Joins sheet 10)



(Joins sheet 18)

1 740 000 FEET

560 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 11

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 12

N

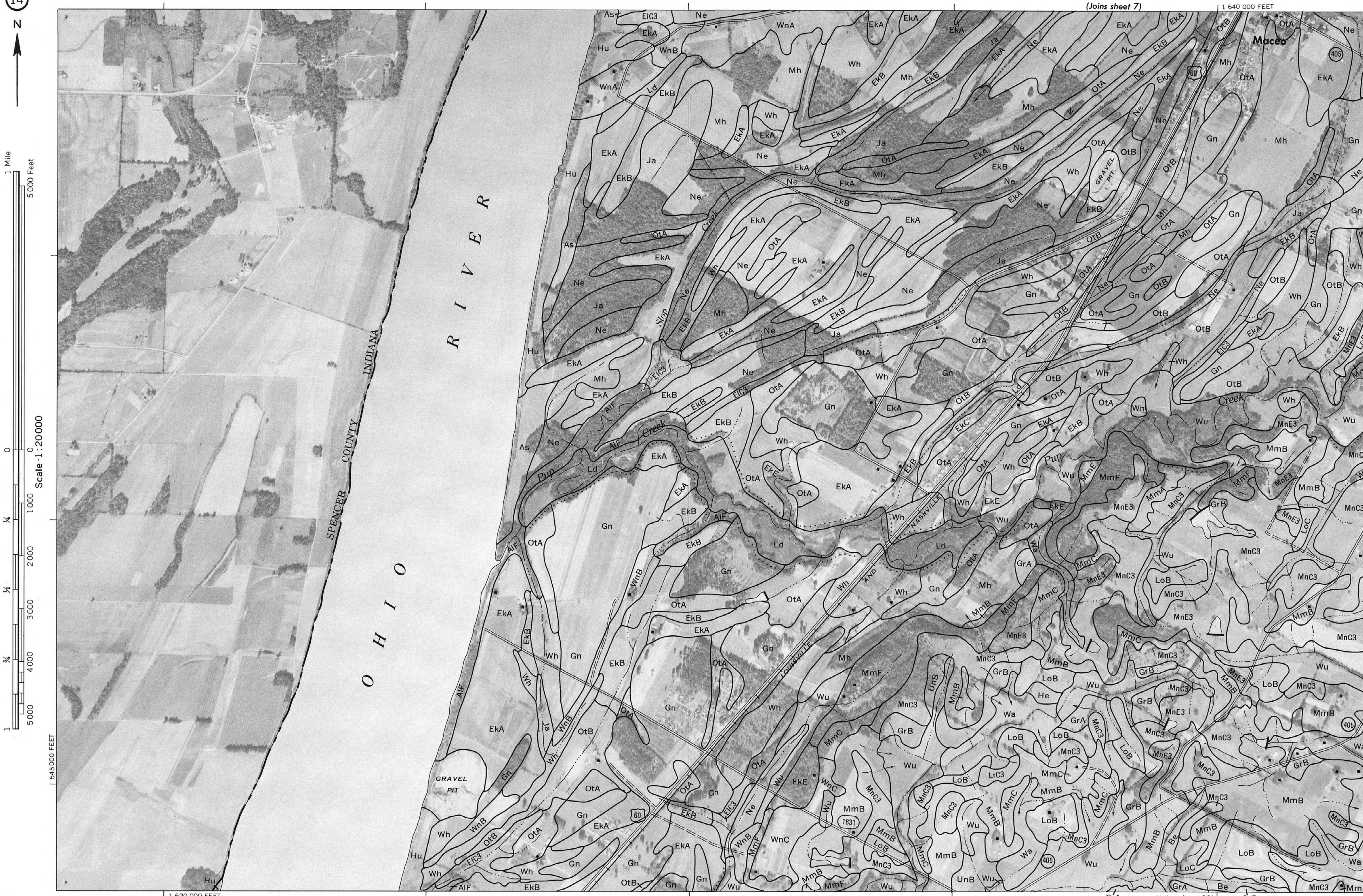
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
Scale 1:20000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 12

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 13

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 14

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 15

15

N

Scale 1:20000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 15

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

16

N

(Joins sheet 9)

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 16

1 690 000 FEET

(Joins sheet 15)

Scale 1:20000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

545 000 FEET

555 000 FEET

(Joins sheet 17)

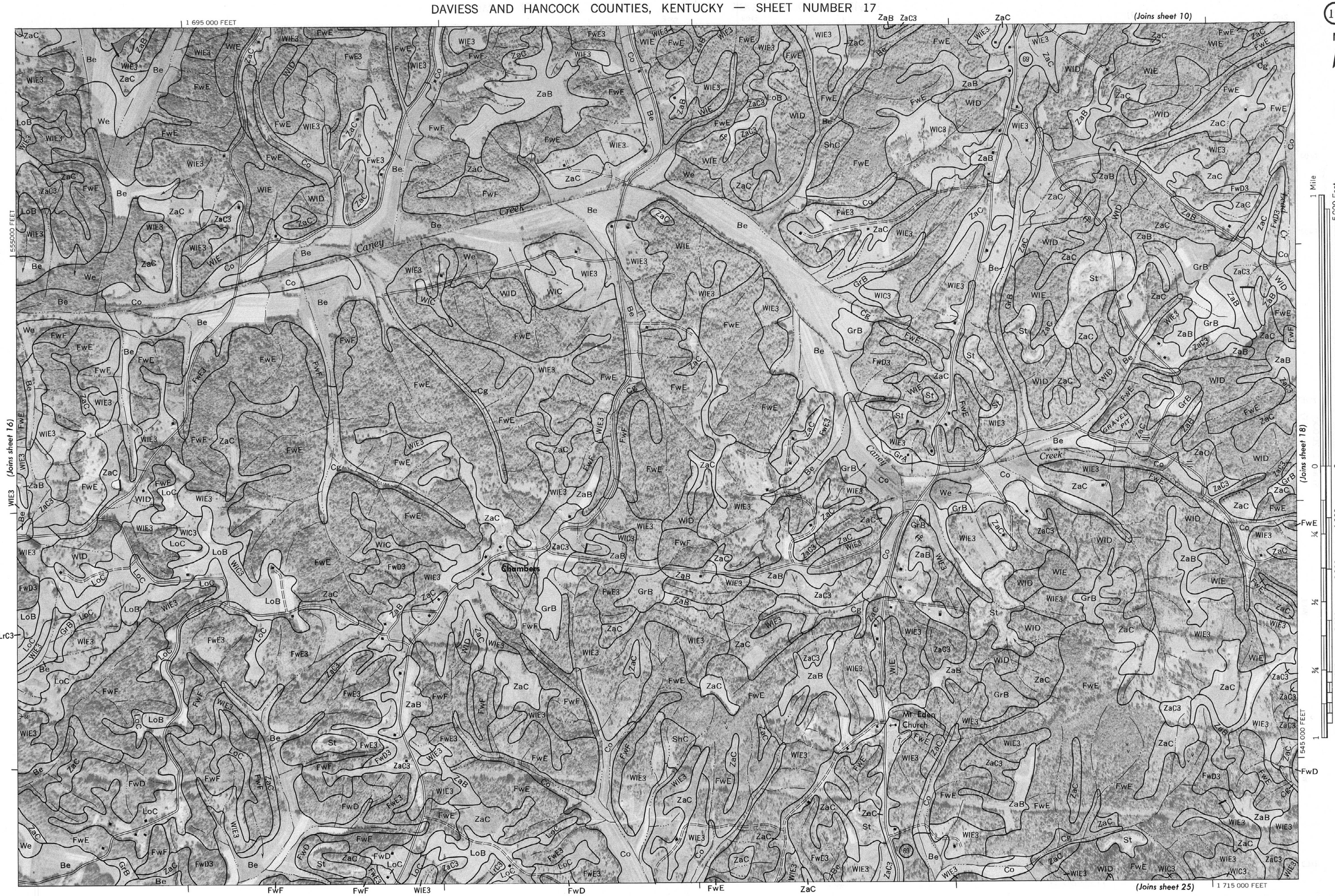
(Joins sheet 24)

1 670 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 16



DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 17

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

18

N

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 18

(Joins sheet 11)

1 740 000 FEET

555 000 FEET

545 000 FEET

(Joins sheet 17)

Scale 1:20000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 26)

1 720 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 18

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 19

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 20

N

1 Mile
5000 Feet

Scale 1:20000

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

(Joins sheet 13)

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 20

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 21

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 22

N

Scale 1:20000

1 Mile ¾ ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

23

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 23

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

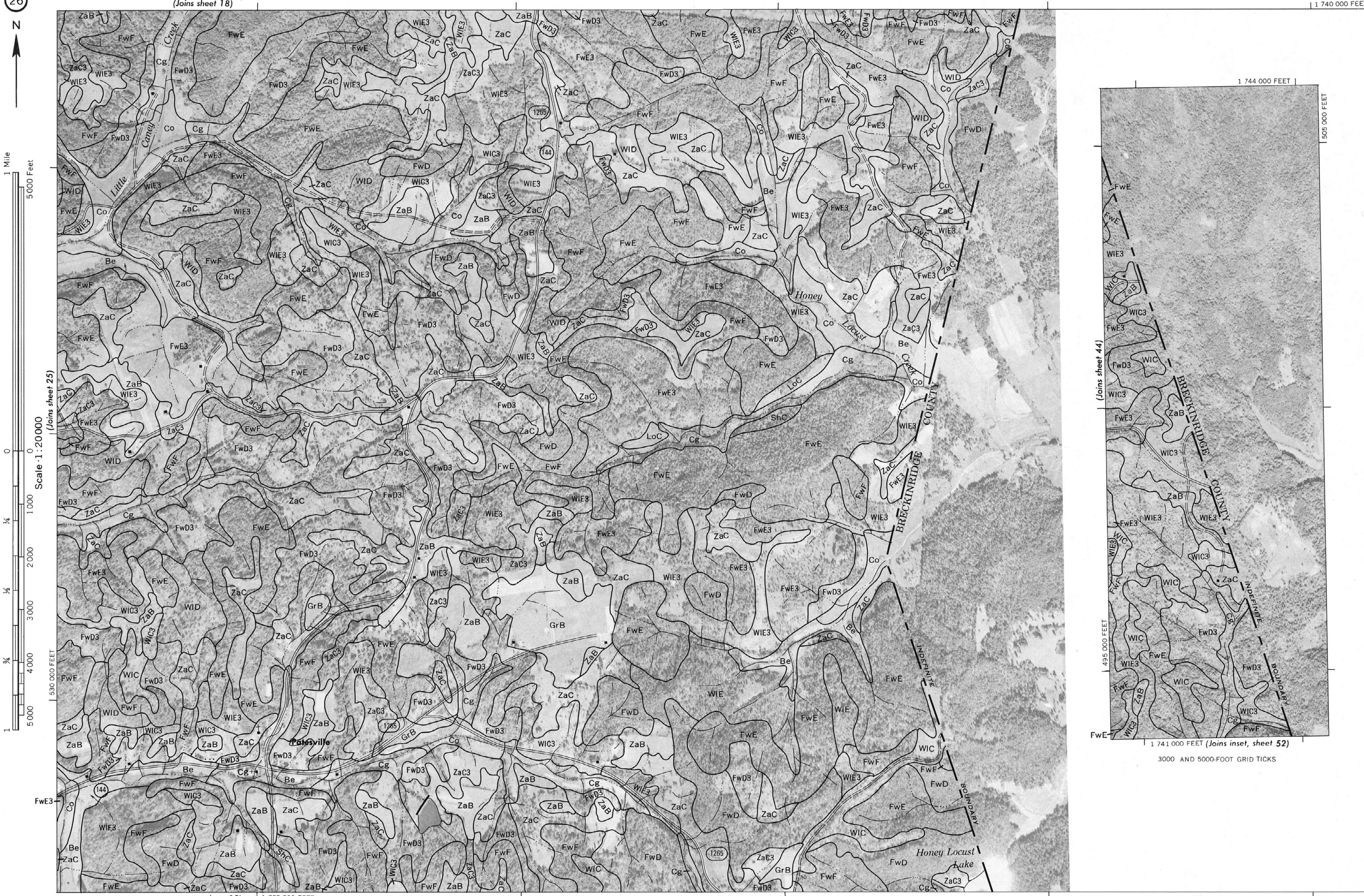
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

25

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 25

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 26



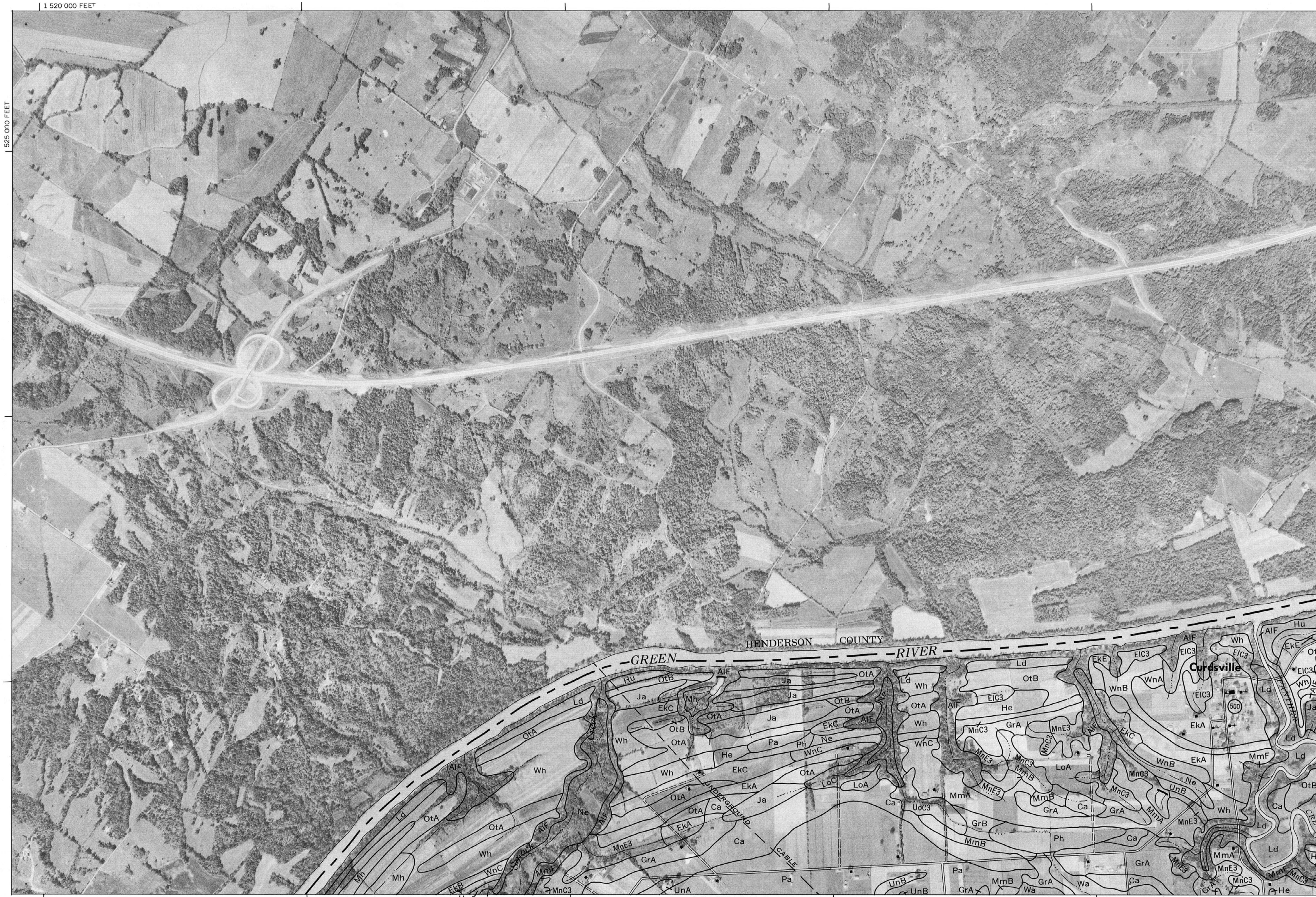
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 26

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 27

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.



27

N

Scale 1:20000

1 Mile

5 000 Feet

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 28

N

Scale 1:20 000

1 Mile ¾ ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

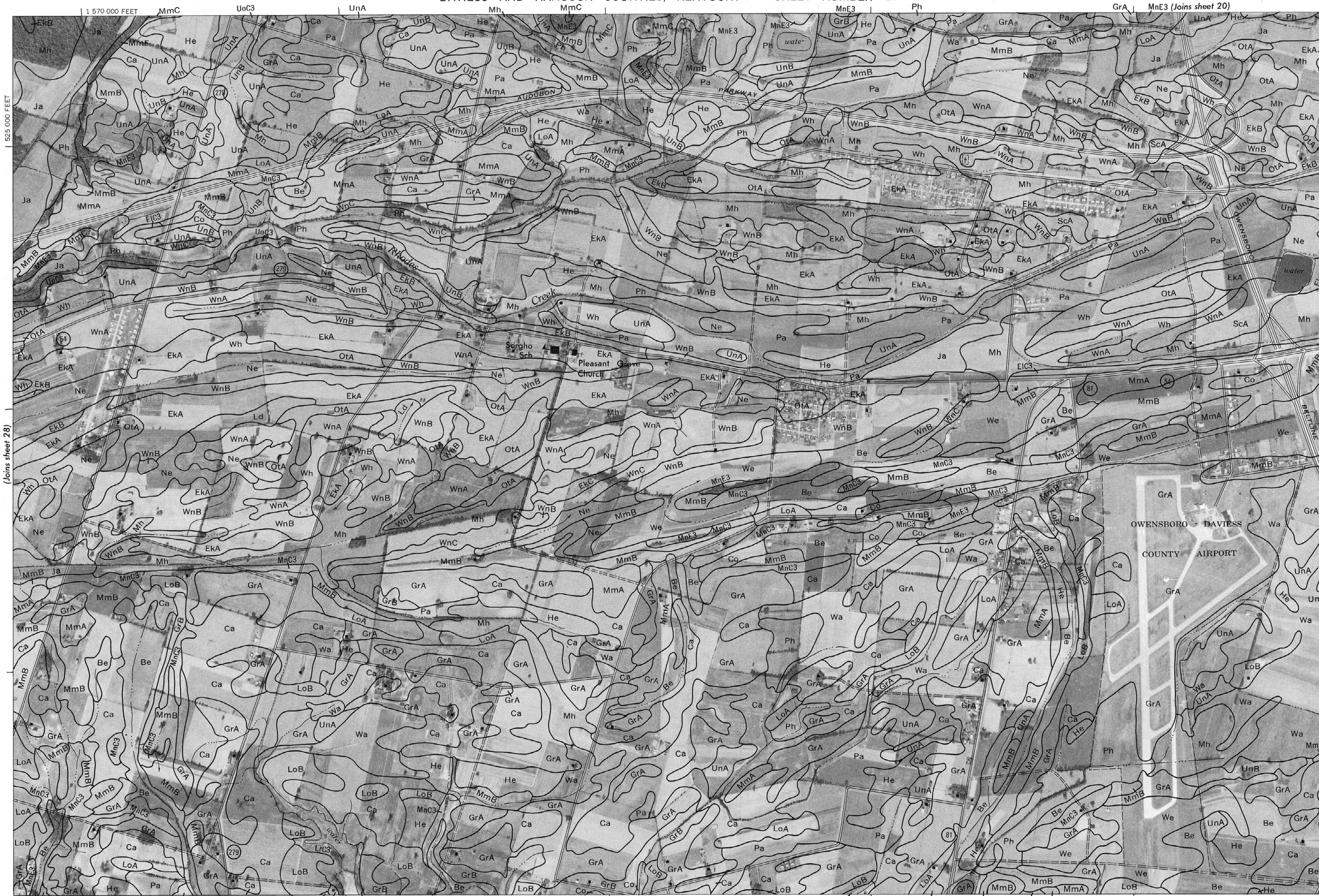
DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 29

29

N

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 29

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.



1 Mile
5000 Feet
Scale 1:20000

30

N

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 30

(Joins sheet 21)

1 615 000 FEET

525 000 FEET

515 000 FEET

(Joins sheet 29)

(Joins sheet 31)

1 595 000 FEET

(Joins sheet 39)

1 Mile

5 000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 30

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 31
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 32

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 33

33

(Joins sheet 24)

N

Scale 1:20000

1 Mile
5 000 Feet

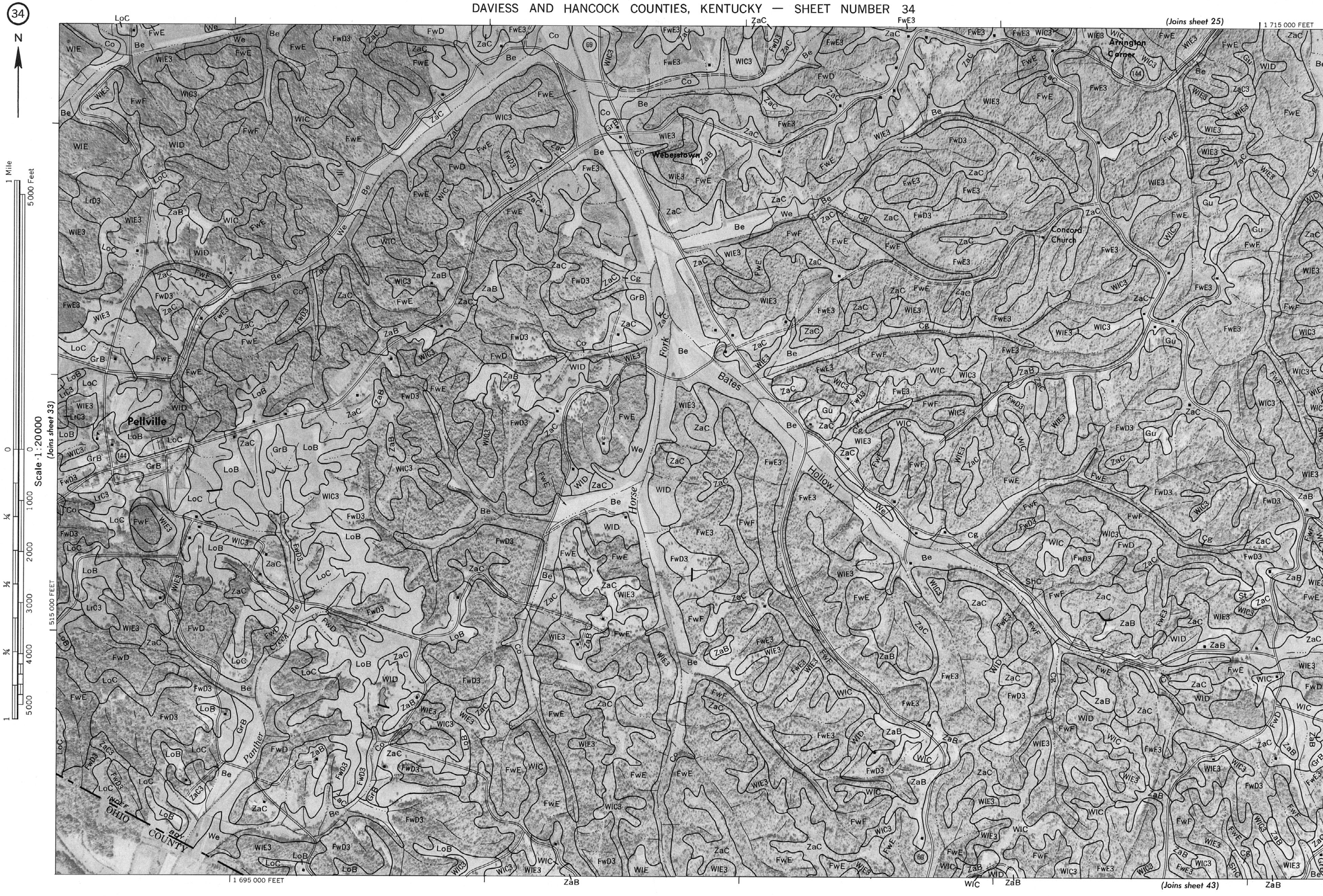
0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 33

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 34



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 35

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 36

N

1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

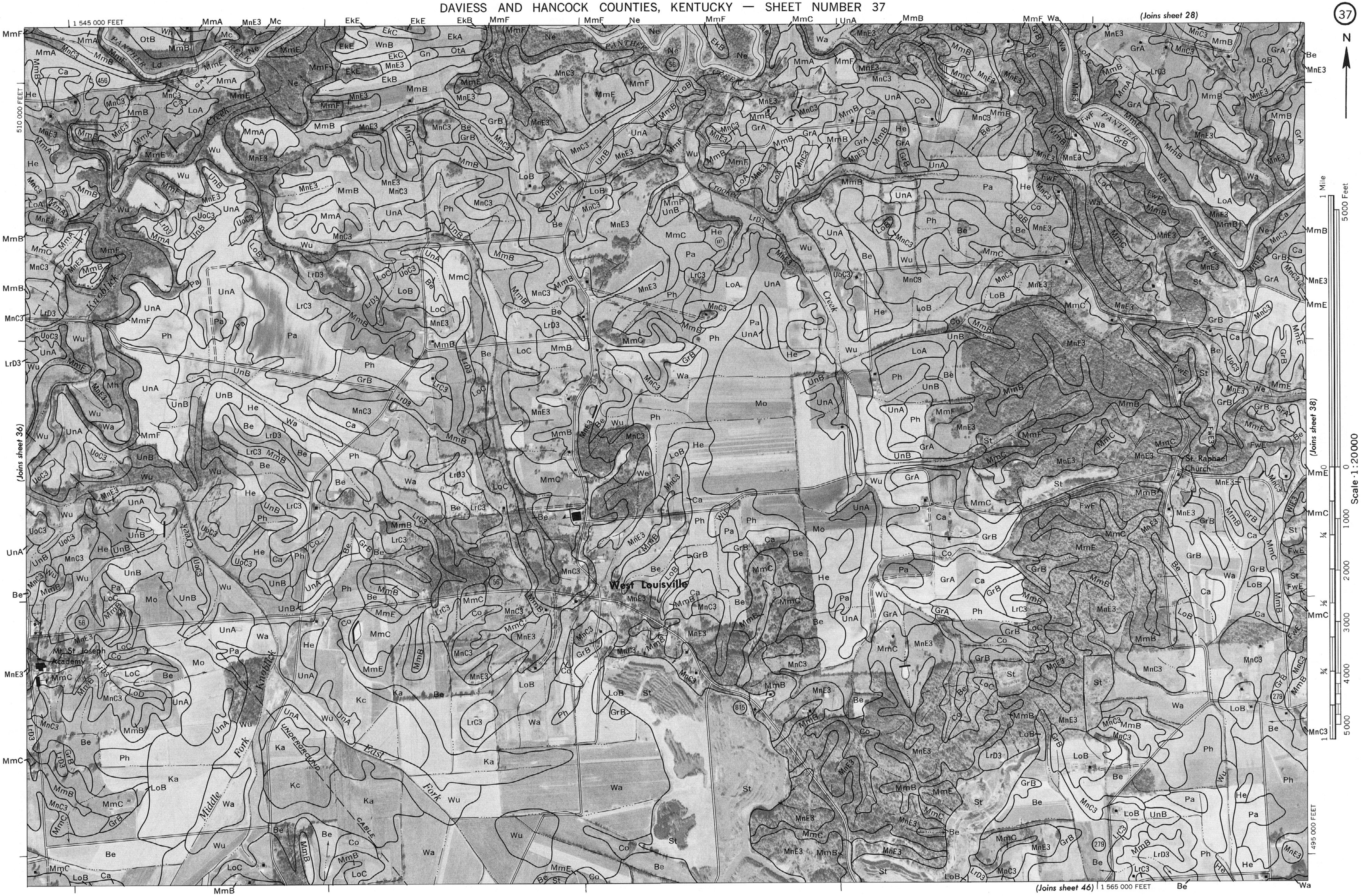
Ld
1 540 000 FEET
MmF (Joins sheet 27) MmF MmB
510 000 FEET
(Joins sheet 37)

495 000 FEET
1 520 000 FEET
MeB2
MnC3
MnE3
(Joins sheet 45)
MnC3

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 36



DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 37

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 38

39

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 39

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 40

(Joins sheet 31)

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 41

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 42

N

(Joins sheet 33)

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

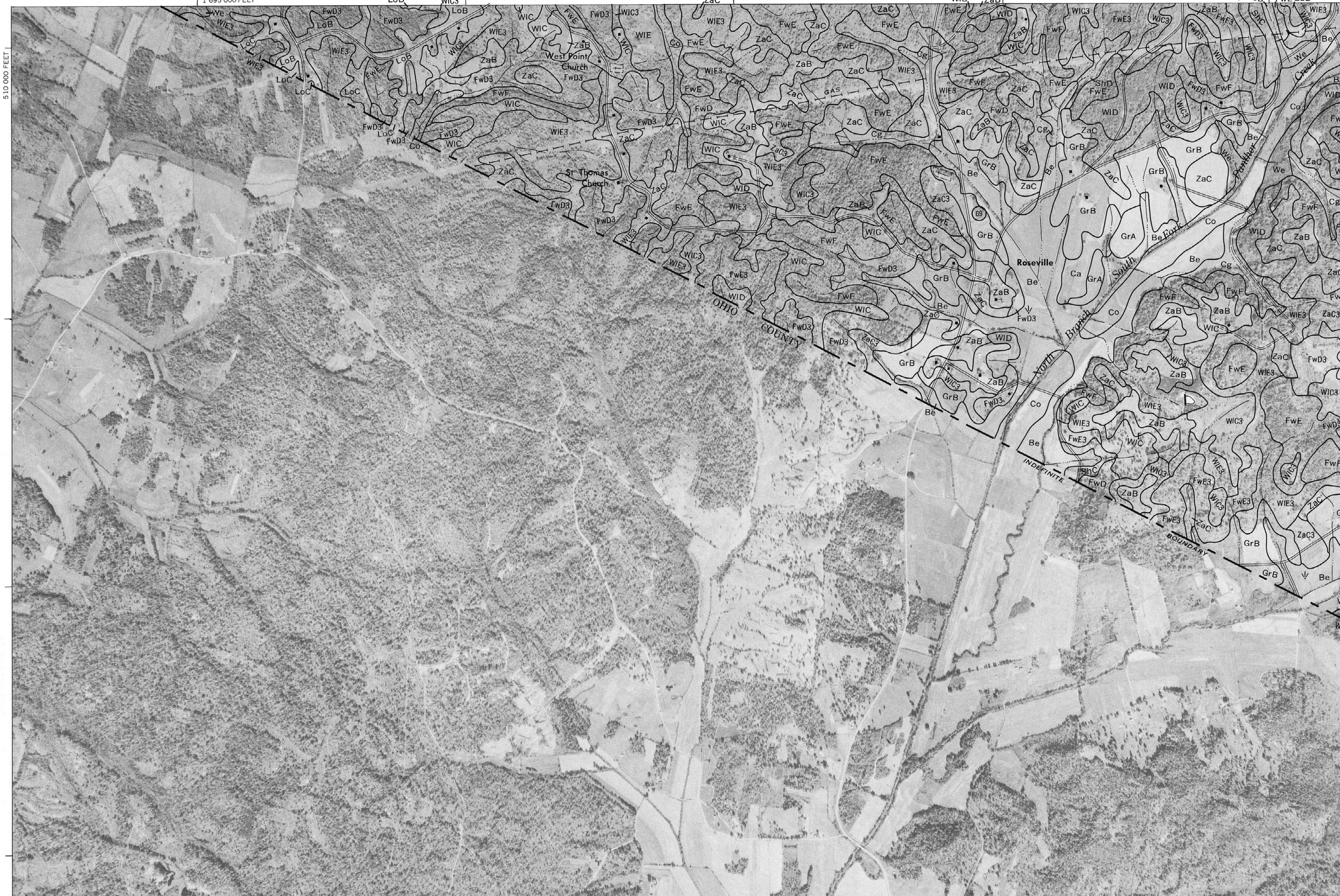
0 1000 2000 3000 4000 5000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

43

(Joins sheet 34)



(Joins sheet 44)

N

1 Mile ½ ¼ 0 1
5000 Feet 4000 3000 2000 1000 0 5000

Scale 1:20000

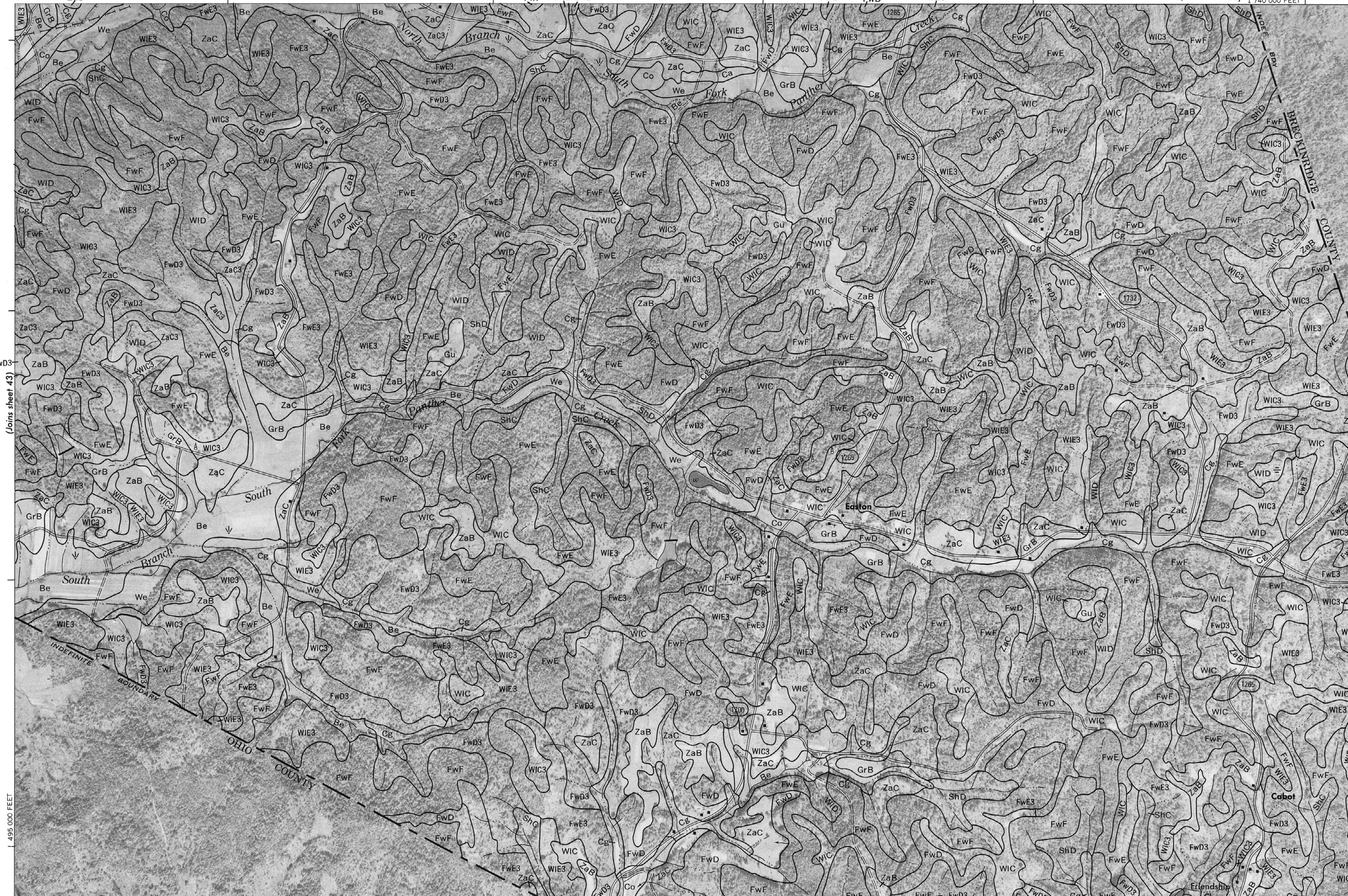
DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 43

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 44

N

(Joins sheet 35) 1 740 000 FEET



1 Mile 5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

(Joins sheet 43)

(Joins inset, sheet 26)

510 000 FEET

495 000 FEET

1 720 000 FEET

(Joins sheet 52)

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 44

Scale 1:20000

1 Mile

5000 Feet

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 45

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 46

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

47

N

Scale 1:20000

0 ¼ ½ ¾ 1 Mile

0 1000 2000 3000 4000 5000 Feet

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 47

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 48

N

(Joins sheet 39)

1 615 000 FEET

1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20 000
(Joins sheet 47)

490 000 FEET

480 000 FEET

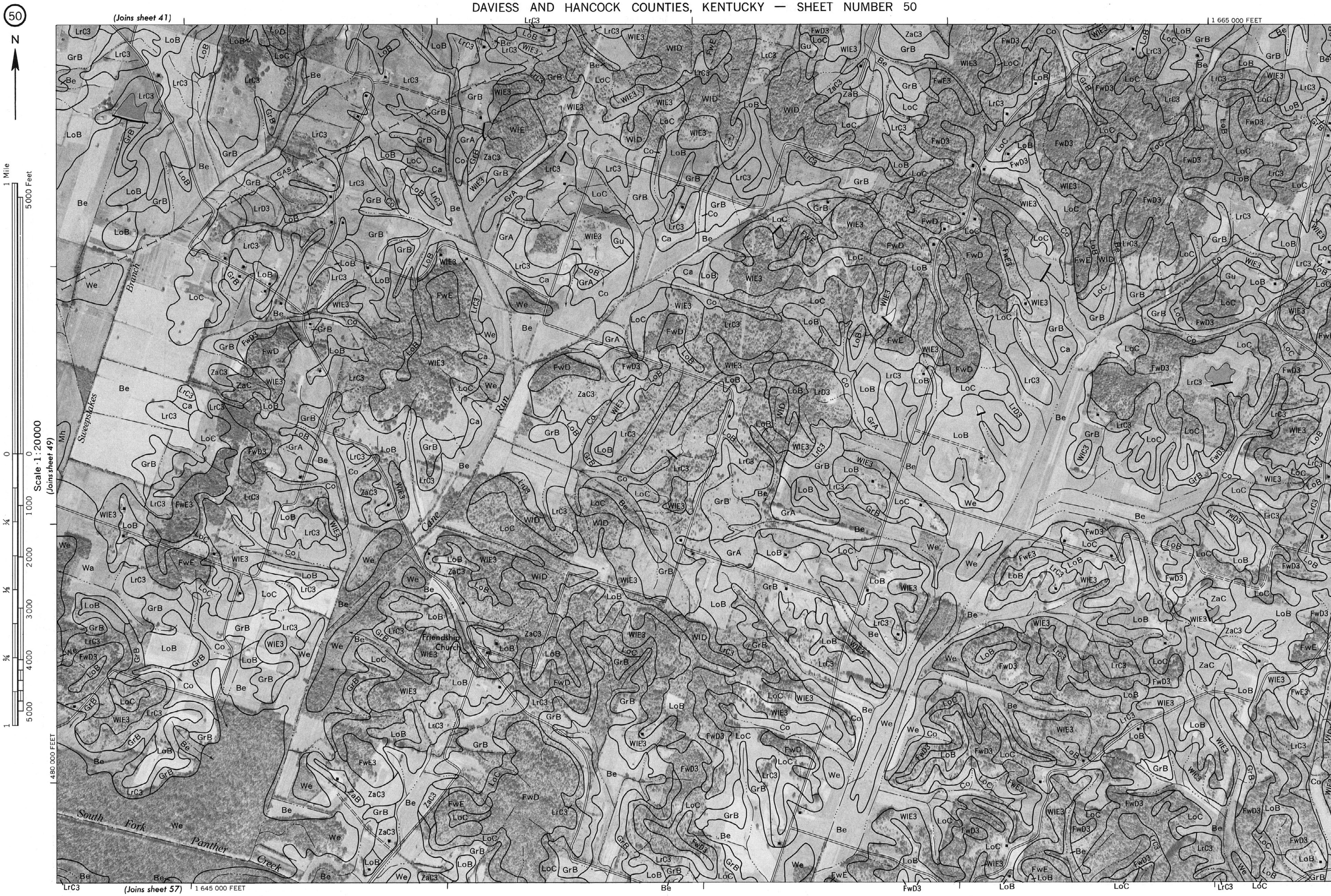
(Joins sheet 49)

1 595 000 FEET (Joins sheet 55)

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 49

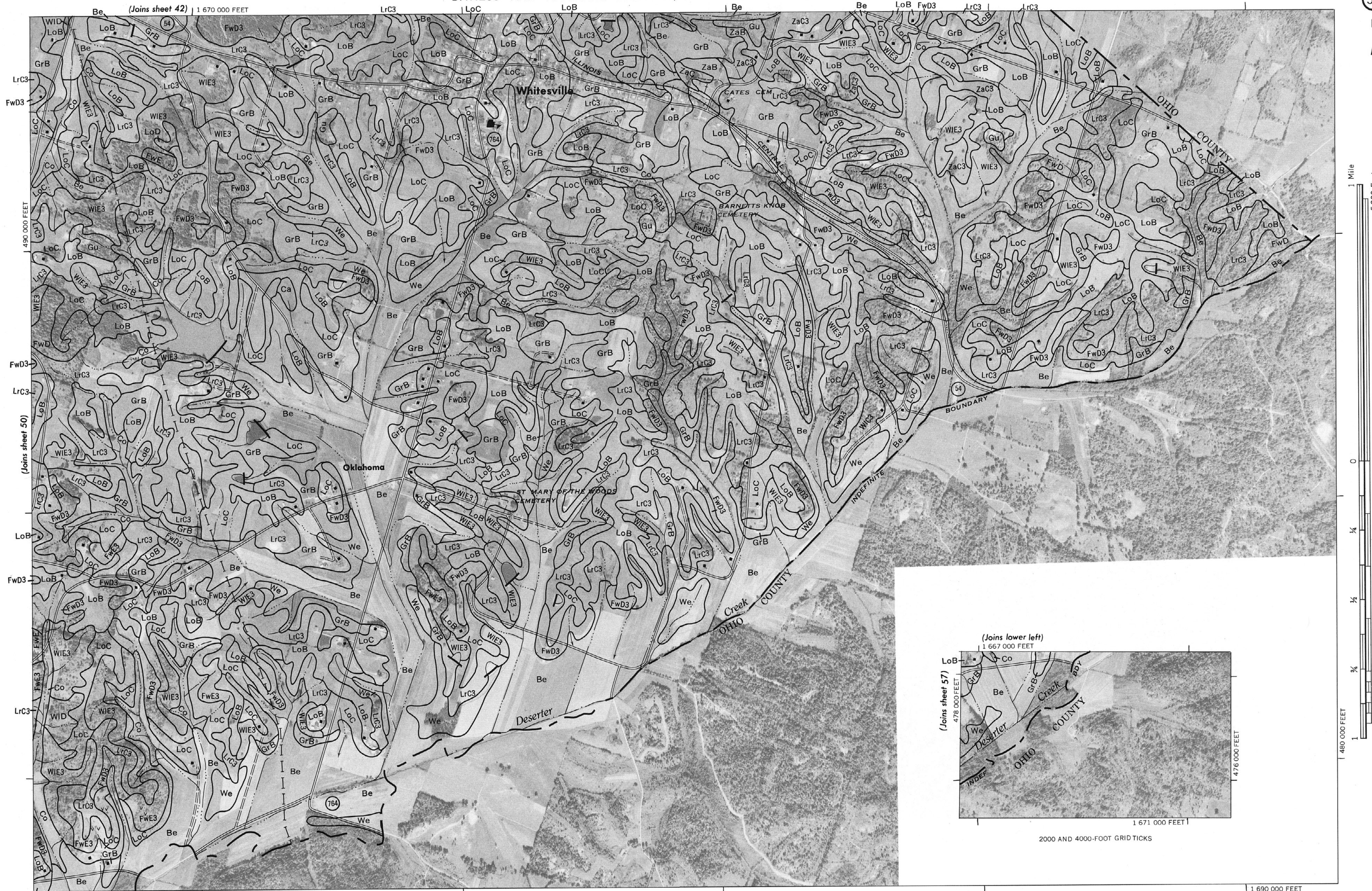
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 51

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.



DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 52

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

N

1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20000

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 53

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 54

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 54

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 55

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 55

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 56

N

Scale 1:20000

1 Mile ¾ ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

57

N

1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20000

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 57

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 58

DAVIESS AND HANCOCK COUNTIES, KENTUCKY — SHEET NUMBER 59

DAVIESS AND HANCOCK COUNTIES, KENTUCKY NO. 59

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.